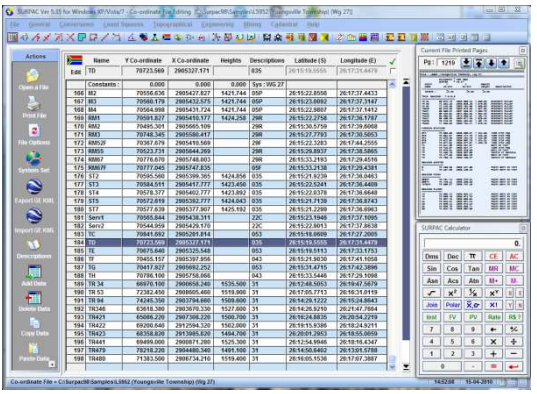
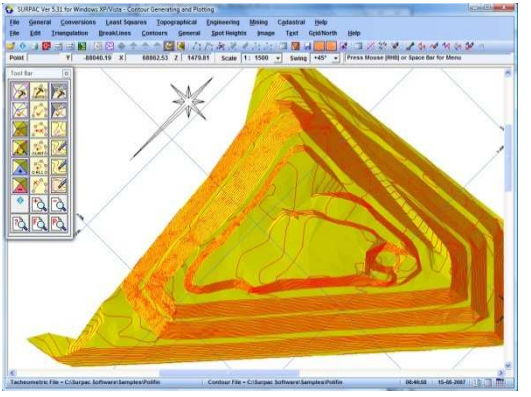
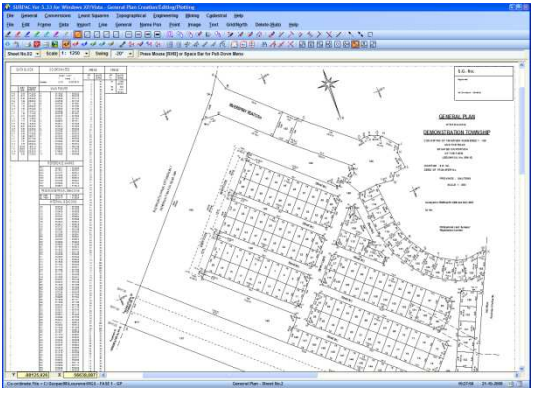
SURPAC Surveying Software User's Manual - Book #3

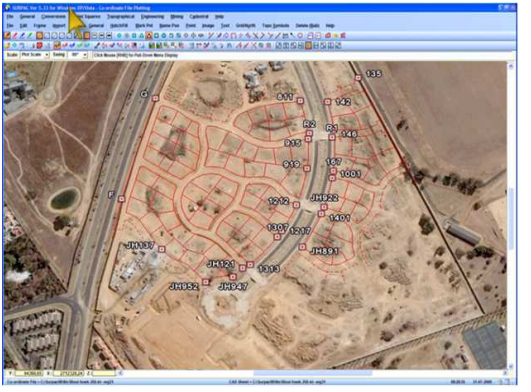
Covering the SURPAC Google Earth Functions

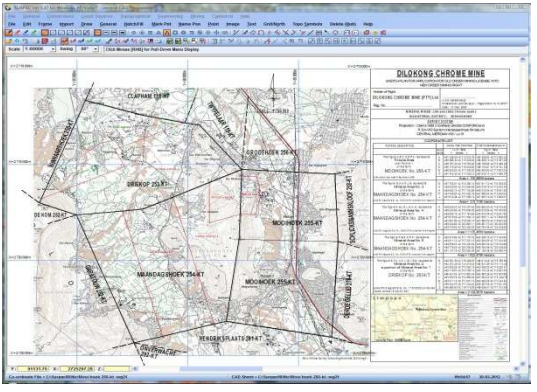
By ***K. W. Young***

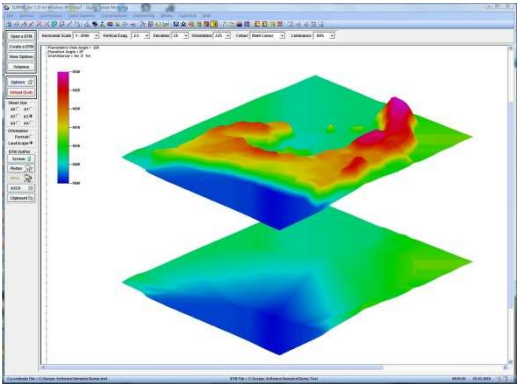












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SURPAC Surveying Software
User's Manual
Book #3

SURPAC - Google Earth Functions

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SURPAC Google Earth Linear and Graphic Functions

Google Earth allows for the viewing of 2D or 3D colour satellite imagery for any point on the Earth, as well as being able to view galaxies and the ocean floors.

The surface terrain imagery can usually be viewed at a scale in the region of 1:2500 without any loss of detail quality. This figure can vary from region to region, but it is generally true for built up areas.

Google Earth, therefore, makes a very useful visual display tool for **SURPAC** Users when it is interfaced, or linked, with survey co-ordinate and/or image data.

This interfacing can be in the form of :-

- *Displaying the locations of **Trig**. **Beacons** and/or **Town Survey Marks** for a selected area on **Google Earth**.*
- *Displaying **Beacons** and **Stations** from a previous survey on **Google Earth** to help locate these points.*
- *Displaying User selected **Points** in a Co-ordinate file on **Google Earth** to help locate these points.*
- *Displaying User selected **Precise Level Bench Marks** (RSA only) on **Google Earth** to help locate these points.*
- *Displaying **Points** and/or **Lines** from a survey plan, or sheet, to view their positions on **Google Earth**.*
- *Displaying a survey **Plan**, or **Sheet** as an overlay on **Google Earth**.*
- *Displaying **SURPAC 3D Contours** and **DTM**s on **Google Earth**.*
- *Displaying **General CAD Polygons** on **Google Earth**. Displaying **Image Placemarks** and **Image Polygons** on **Google Earth**.*
- *Importing a **Placemark** created in **Google Earth** into **SURPAC**.*
- *Importing a **Line**, **Path** or **Polygon** created in **Google Earth** into the **SURPAC General CAD**.*
- *Importing a **Google Earth Image** into the **SURPAC General CAD**.*
- *Adding **Google Earth DTM** interpolated **Heights** for existing **Co-ordinate File Points**.*

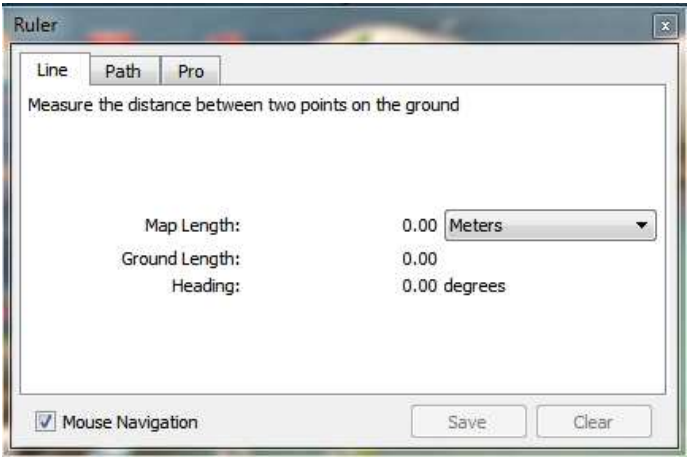
- *Comparing **Google Earth DTM** interpolated **Heights** with existing **Co-ordinate File Point Heights**.*
- *Importing and Adding **Google Earth DTM** interpolated **Heights** for a User defined set of grid mesh Points in a **Tacheometric File**.*
- *Comparing **Google Earth DTM** interpolated **Heights** with existing **Tacheometric File Points**.*

Requirements for SURPAC interfacing with Google Earth

1. **Google Earth** must be installed on the computer. If you do not already have **Google Earth** installed, visit **http://earth.google.com/** and follow the on-screen instructions for installing this software. The basic version of **Google Earth** is free and is quite suitable for the **SURPAC** interface functions discussed below. There is the option of the **Google Earth Pro** version, but at a cost of US$400 (about R2,500).
2. The currently loaded **Co-ordinate** file in **SURPAC** must use either the **WGS 84** ellipsoid, the **GRS80** ellipsoid or any other ellipsoid having the same parameters as the **WGS 84** ellipsoid.
3. A reasonably fast **ADSL** or **3G** wireless internet connection.

Setting Google Earth Display for SURPAC Data and Overlays

1. The **SURPAC** data displayed on **Google Earth** does not always provide an exact visual fit on to the satellite imagery. In order to force the displayed data to fit as close as possible to the imagery, you can use the Google Earth **Ruler** tool to determine the **Y**, **X** (or **E**, **N**) shifts to be applied to the **SURPAC** data, or image, so that it best fits the imagery.



2. A plan, or sheet, that is displayed on **Google Earth** as an overlay can have varying levels of **transparency** applied to it. Increasing an overlay's transparency allows more of the imagery lying under the overlay to become visible. Setting a zero transparency will allow the overlay to completely hide the underlying imagery. *Note that on **Google Earth** itself there is a "slide" option (on the **Sidebar** information display) that allows for further refinement of the overlay's transparency level.*

3. An overlay of a plan, or sheet, may also be viewed whereby the sheet background is completely transparent, i.e. only the detail on the sheet, such as the lines, text, hatching etc. will be displayed. For this option to apply, the sheet background colour has to be white, which is the case for all **SURPAC CAD** sheets.

4. **Line** information sent from **SURPAC** to **Google Earth** can have the following options :-

   - Users can set the **Lines** to be sent using their defined **Line Thickness** values.
   - Users can set the **Lines/Arcs/Circles** to be sent using their **CAD** defined **Line Colour** values.
   - If **Lines/Arcs/Circles** are to be sent using a **Single Colour**, then this colour can be User defined.

All **SURPAC CAD** programmes which use the **Google Earth** display function have a menu item whereby the **Google Earth** display options may be set or viewed.

The options may also be set by clicking the **[File options]** button when in the "**Co-ordinate File Editing**" programme.

The Locate and Add Nearest Trig/TSM Beacons Programme

This programme provides the facility of locating a set of the nearest Trigonometrical Beacons and/or Town Survey Marks (TSMs) to a User defined geographical position.

If required, the located Points may be added to the current Co-ordinate File and/or displayed on Google Earth .

Currently, this programme is limited to the geographical area of :-

1. The Republic of **South Africa**, and to surveys defined as using either the "Lo" (Clarke 1880 (Modified) Ellipsoid) System or the "WG" (WGS 84 Ellipsoid) System (also referred to as the "Cape Datum" and the "Hartebeesthoek94 Datum respectively.

2. The Republic of **Zimbabwe**, and to surveys defined as using either the "Lo" (Clarke 1880 (Modified) Ellipsoid) System or the "WG" (WGS 84 Ellipsoid) System using the Universal Transverse Mercator (UTM) Zone 35 System.

3. The Republic of **Zambia**, and to surveys defined as using either the "Lo" (Clarke 1880 (Modified) Ellipsoid) System or the "WG" (WGS 84 Ellipsoid) System using the Universal Transverse Mercator (UTM) Zone 35 System.

It is not necessary for the User to define any source file for the location of the Trig. Beacons, or TSMs. **SURPAC** has built in Source Files which must exist in the folder in which **SURPAC** Software is installed (usually the folder "C:\Surpac Software"). These are the same files used by the **SURPAC** "Lo" to/from "WG" transformation programme.

Each of the above Source Files contains the double precision geographical positions (about 48,000 Points throughout the Republic of South Africa), in the "Lo" (Clarke 1880 (Modified) Ellipsoid) and "WG" (WGS 84 Ellipsoid) respectively. Should you not have these Source Files already loaded on your PC, or Laptop, you may download them from the "Upgrade" section of the Internet site **www. surpac.co.za** .

This programme will automatically search and extract the "Lo" or "WG" Point information from the appropriate Source File.

Important notes :

The above mentioned SURPAC Source Files are random binary files and, as such, the data they contain are not printable, or accessible to Users. Further, the data contained in these files have had variable, false origin shifts applied to them making the data meaningless even to someone who is able to "hack" their way into the files.

Anyone attempting to use data extracted from either of the two files is warned that highly inaccurate results will occur!!

Keith W. Young and SURPAC Surveying Software are not responsible, nor are they liable for any damages or misinformation resulting from the unauthorized use of these data.

Since these Source File Points are stored in shifted [Lat, Long] format, any Degree Square boundaries become irrelevant to the programme. Surveys can be located close to any Degree Square boundary, and the programme will still generate its own "Degree Square" of Points, centred about the Survey, or any defined Point in the Survey. Data may be drawn from different Degree Squares for any given Survey.

The programme offers User options for both the selection of Points, and the display mode, namely :-

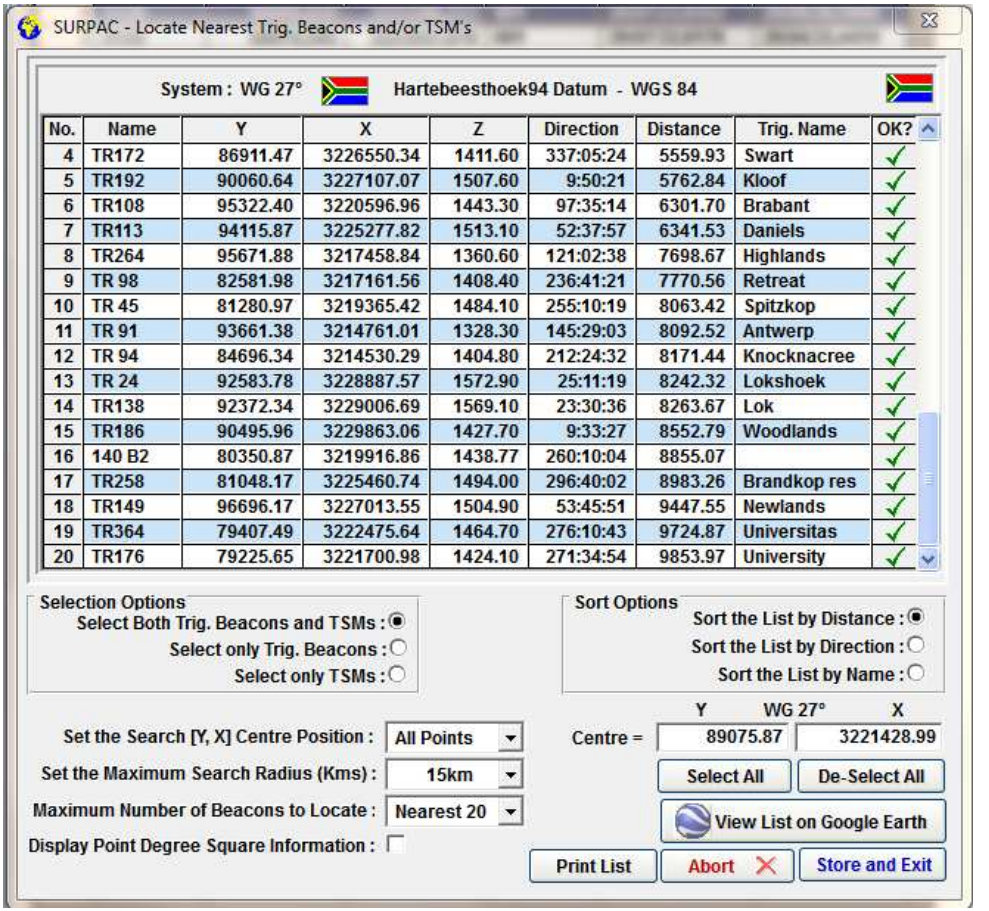
- The **Search Centre** position may be User selected,
- The located Points may be either **Trig**. **Beacons**, **TSMs**, or **both**,
- The **number** of locate Points displayed may be set according to a required **maximum number**, or a required **maximum search radius**,
- The **display** of located Points may be in order of **Distance**, **Direction** or **Point Name**,
- Any of the located **Points** in the displayed list may be tagged as "**not required**", to prevent them from being added to the Co-ordinate File,
- Any located **Point** in the displayed list may have its **Degree Square**, **Latitude** and **Longitude** shown on a sub-display, for identification purposes,
- An **output** of the displayed list of located **Points** may be made to the **Printer**, an **ASCII** file or the **Clipboard**,
- The located **Points** in the displayed list, marked as "**required**" (i.e. the ticked Points) may be added to the current **Co-ordinate File**, and

- The located **Points** in the displayed list, marked as "**required**" (i.e. the ticked Points) may be displayed on **Google Earth**.

Running the Programme

The programme may be loaded in any of three different ways, namely :-

1. Using the "Locate and Add the Nearest Trig/TSM Beacons" Menu Item under the **Conversions Menu**, or
2. In the **Co-ordinate Editing** Programme, click the Mouse RHB and from the displayed Menu, select the "Locate and Add Nearest Trig/TSM Beacons" Item, or
3. In the **Co-ordinate Editing** Programme, click the [**Options**] Button, select the "Locate and Add Nearest Trig/TSM Beacons" option and then From the **Conversions** Menu, select the Locate and Add Nearest click the [**OK**] Button.



No.	Name	Y	X	Z	Direction	Distance	Trig. Name	OK?
4	TR172	86911.47	3226550.34	1411.60	337:05:24	5559.93	Swart	✓
5	TR192	90060.64	3227107.07	1507.60	9:50:21	5762.84	Kloof	✓
6	TR108	95322.40	3220596.96	1443.30	97:35:14	6301.70	Brabant	✓
7	TR113	94115.87	3225277.82	1513.10	52:37:57	6341.53	Daniels	✓
8	TR264	95671.88	3217458.84	1360.60	121:02:38	7698.67	Highlands	✓
9	TR 98	82581.98	3217161.56	1408.40	236:41:21	7770.56	Retreat	✓
10	TR 45	81280.97	3219365.42	1484.10	255:10:19	8063.42	Spitzkop	✓
11	TR 91	93661.38	3214761.01	1328.30	145:29:03	8092.52	Antwerp	✓
12	TR 94	84696.34	3214530.29	1404.80	212:24:32	8171.44	Knocknacree	✓
13	TR 24	92583.78	3228887.57	1572.90	25:11:19	8242.32	Lokshoek	✓
14	TR138	92372.34	3229006.69	1569.10	23:30:36	8263.67	Lok	✓
15	TR186	90495.96	3229863.06	1427.70	9:33:27	8552.79	Woodlands	✓
16	140 B2	80350.87	3219916.86	1438.77	260:10:04	8855.07		✓
17	TR258	81048.17	3225460.74	1494.00	296:40:02	8983.26	Brandkop res	✓
18	TR149	96696.17	3227013.55	1504.90	53:45:51	9447.55	Newlands	✓
19	TR364	79407.49	3222475.64	1464.70	276:10:43	9724.87	Universitas	✓
20	TR176	79225.65	3221700.98	1424.10	271:34:54	9853.97	University	✓

If the current Co-ordinate File is empty, the programme will display a warning message and abort. The Co-ordinate File must contain at least one Point in order for this programme to work.

The Co-ordinate File should have appropriate constants set. If no constants are used, then both the Y an X ordinates must have full values.

As a starting default, the programme will assume the [Y, X] search position as being the centre of gravity of all existing Points in the current Co-ordinate File. The programme will use the further defaults of a Search Radius of 15Km and the number of Points to display as 10.

The results of this default search will be displayed. You may now change any of the search parameters required including :-

- The **search centre** position,
- The **number** of located **Points** to display,
- The **maximum** search **radius**,
- The **type** of **Points** to locate and display (Trig. Beacons, TSMs, or both),
- The **display order** of located Points (by Distance, Direction or Name).

Each displayed Point will initially have a green "tick" displayed next to it. This implies that the Point is a "required" Point which would be added to the current Co-ordinate File when the [**Store and Exit**] Button is clicked.

If any Point is not required, then click on that Point's green "tick". The Point's symbol will be changed to a red "cross", and the Point's co-ordinate display will be changed to a grey, italic font. This Point will now be flagged as "not required", and will not be added to the current Co-ordinate File. Clicking a Point's red "cross" will reverse the above process.

Click the [**Print List**] Button to send all those located Points in the list that have green "tick" symbol next to them, to the **SURPAC** Printing form. From this form display, this list may be sent to the current Printer, to a User defined ASCII file or to the ***Windows*** Clipboard.

When the [**Store and Exit**] Button is clicked, all located Points displayed in the list, and having the green "tick" symbol next to them, will be added to the current Co-ordinate File.

By clicking on the **Google Earth** icon on the form, it is possible to send the list of selected Trig Beacons and/or Town Survey Marks (TSMs) to **Google Earth** for a spatial view of the set of Trig beacons.

By clicking on a Trig Beacon/TSM symbol on the **Google Earth** display, the Trig's co-ordinate and height information is displayed (see below).

Displaying the Nearest Trig/TSM Beacons on Google Earth

1. In **SURPAC** run the **Locate and Add Nearest Trig/TSM Beacons** programme from the **Conversions** main menu heading *(if your **SURPAC** License has this Module)*.
2. Set the search options at the bottom of the form so as to display the required number and type of beacons.
3. From the displayed list of beacons, remove any unwanted beacons by clicking on the green tic shown at the end of each display line. The green tic will change to a red cross. This point will remain "dormant" and will not be displayed until clicked again.
4. Click on the **[View List on Google Earth]** button at the bottom right of the form.

SURPAC will open and run **Google Earth** and the selected beacons will be displayed at their surface positions on the satellite imagery. Either a **Trig**. **Beacon** or a **TSM** symbol (icon) will be used to mark the displayed beacons. To obtain a beacon's information, click on the beacon required.

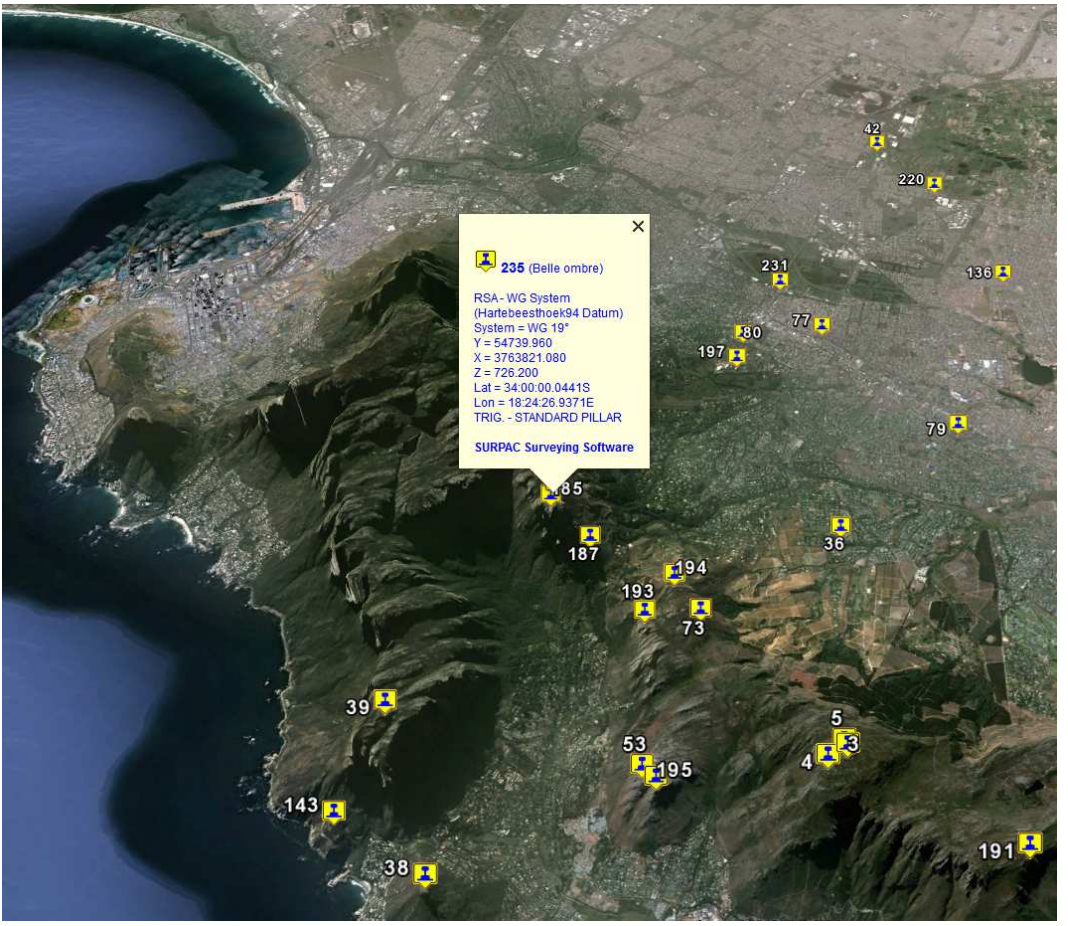
A balloon text display will then appear showing :-

The Beacon/TSM Name
The Degree Square (Trig Beacons only)
The Co-ordinate System (e.g. WG29)
The Beacon Y, X and Z values (or E, N and H values)
The Beacon Latitude and Longitude

The **Google Earth** icons used by **SURPAC** for Trigs and TSMs are :-

- Trigonometrical Beacons

- Town Survey Marks



Example of a 3D View of Trig Beacons displayed on Google Earth

Displaying Points from a Co-ordinate File on Google Earth

1. In **SURPAC**, run the **Co-ordinate File Editing** programme from the **General** main menu heading.

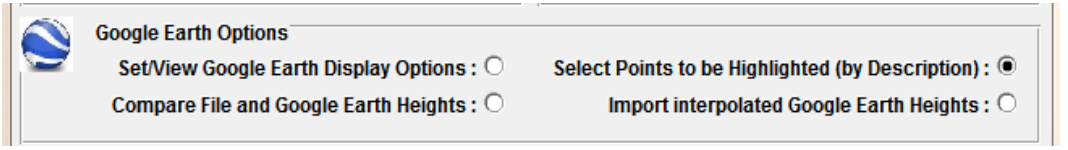
2. **Mark** (i.e. highlight) the **Points** required for viewing on **Google Earth**.

   *2.1 You can **mark a block of Points** by either clicking on the first Point in the block and then dragging the cursor onto the last Point, or by clicking on the first Point in the block then holding*

*down the **Shift** key and simultaneously clicking on the last Point in the block.*

*2.2 You can **mark individual Points** by clicking on the first required Point and then, whilst holding down the **Ctrl** key, click on any other required Points.*

*2.3 You can **mark Points by Description** by clicking on the **[File Options]** button and then selecting the **Select Points to be Highlighted (by Description)** option. Then select the required Descriptions from the displayed list.*


Google Earth Options
Set/View Google Earth Display Options :
Select Points to be Highlighted (by Description) :
Compare File and Google Earth Heights :
Import interpolated Google Earth Heights :

3. After selection, Click the **[Export GE KML]** button on the **Actions Bar** menu.

The Points selected will be displayed at their surface positions on the satellite imagery by **Google Earth**. Either a **Point**, a **Trig**. **Beacon** or a **TSM** symbol (icon) will be used to mark the displayed Points, as is appropriate. To obtain a Point's information, click on the Point required.

A balloon text display will appear showing :-

The Point Name
The Point Description
The Co-ordinate System (e.g. WG29')
The Beacon Y, X and Z values (or E, N and H values)
The Beacon Latitude and Longitude

The **Google Earth** icons used for **Co-ordinate file Points** are :-

- Trigonometrical Beacons

- Town Survey Marks

- Survey Beacons/Points

Interfacing SURPAC CAD programmes with Google Earth

These functions apply to the **General CAD**, **Contour CAD**, **General Plan CAD**, **Sectional Title CAD** and **Working Plan CAD** programmes.

Note that the **Contour CAD** programme only has the **Viewing a SURPAC CAD Sheet on Google Earth** option available.

Viewing a SURPAC CAD Sheet's Lines and Points on Google Earth

Note :-

*If the **Point Display** option is **On**, then only the Points that have been Named (by using the **[PN]** Command) will be displayed on the **Google Earth** overlay.*

*If only **Lines**, **Arcs** and **Circles** are required for the Google Earth display, then Click the **Text** menu heading in the **CAD** programme, and turn the display of **Points OFF**.*

*All **Lines** will be shown in the User selected style, width and colour. (Refer to the options discussed on Page 2).*

***SURPAC** will display **dotted** and/or **dashed Lines** as such on Google Earth. **SURPAC** will also display **Circles** and **Arcs** correctly on Google Earth.*

*All **Points** will be marked by either the **SURPAC** Point marker or, in the case of Trig. Beacons and TSMs, the appropriate control point symbol.*

1. In the **CAD** programme, click on the "**File**" main menu heading and then select the **View Lines and Points on Google Earth** menu item. (Note :- *If the **Point Display** has been turned **Off**, then this menu item will read **View Lines on Google Earth)***.
2. Once the **CAD** sheet Line and Point data have been transferred, **Google Earth** will shift its location to the centre of the imagery covered by the data and will display the data viewed from an appropriate height. The **Orientation** is set to North and there is no **Tilt** applied. All viewing settings can be User modified from within **Google Earth**. Clicking on a displayed Point will show a text balloon containing the Point's values and information.

A proposed layout, showing Lines and Points on Google Earth

Viewing a SURPAC CAD Sheet on Google Earth

Notes :-

*One problem associated with using a **CAD** Sheet as an overlay is that of the **Meridian Convergence**. Since a **CAD** Sheet is always oriented to **Grid North** (the **True North** at the Central Meridian of the projection) and not to **True North** at the Sheet position, **SURPAC** has to swing the **CAD** Sheet display so as to re-orient it to True North for the **Google Earth** display.*

*Before the image of a **CAD** Sheet is sent to **Google Earth** as an overlay, you will notice it being re-drawn in **SURPAC**. This is to both re-orient the Sheet for **Meridian Convergence**, as explained above, and to set the Sheet scale to the defined plotting scale. This latter action is to ensure a clearer Sheet image on **Google Earth**. For the **Windows Vista/7/8** operating systems (which have better graphic*

memory handling then the Windows XP OS), the scale is set to half the defined plotting scale to provide an even clearer overlay image.

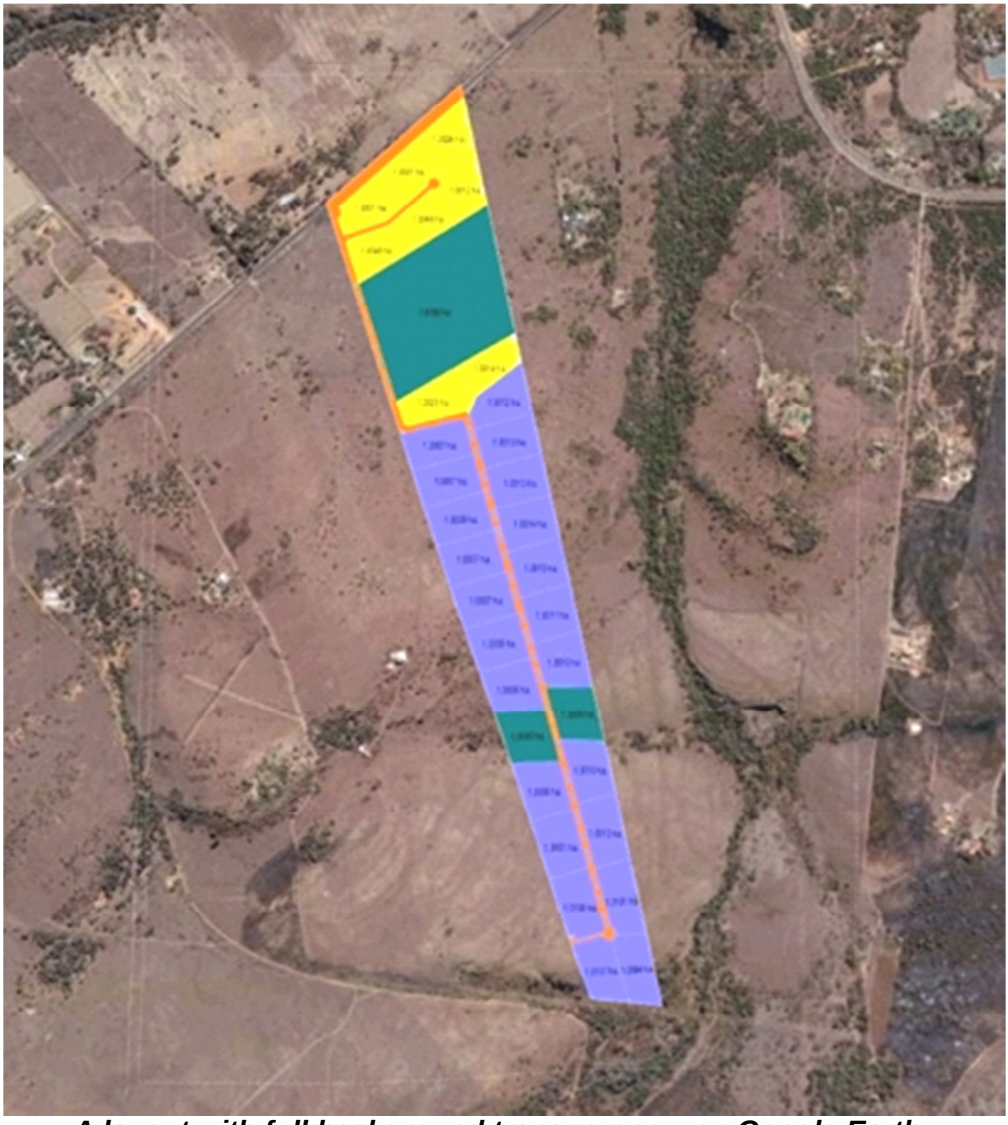
1. In the **CAD** programme, click on the **File** main menu heading and then select the **View Sheet on Google Earth** menu item.
2. Once the **CAD** sheet has been transferred, **Google Earth** will shift its location to the centre of the imagery covered by the Sheet and will display the Sheet viewed from an appropriate height.

Notes :-

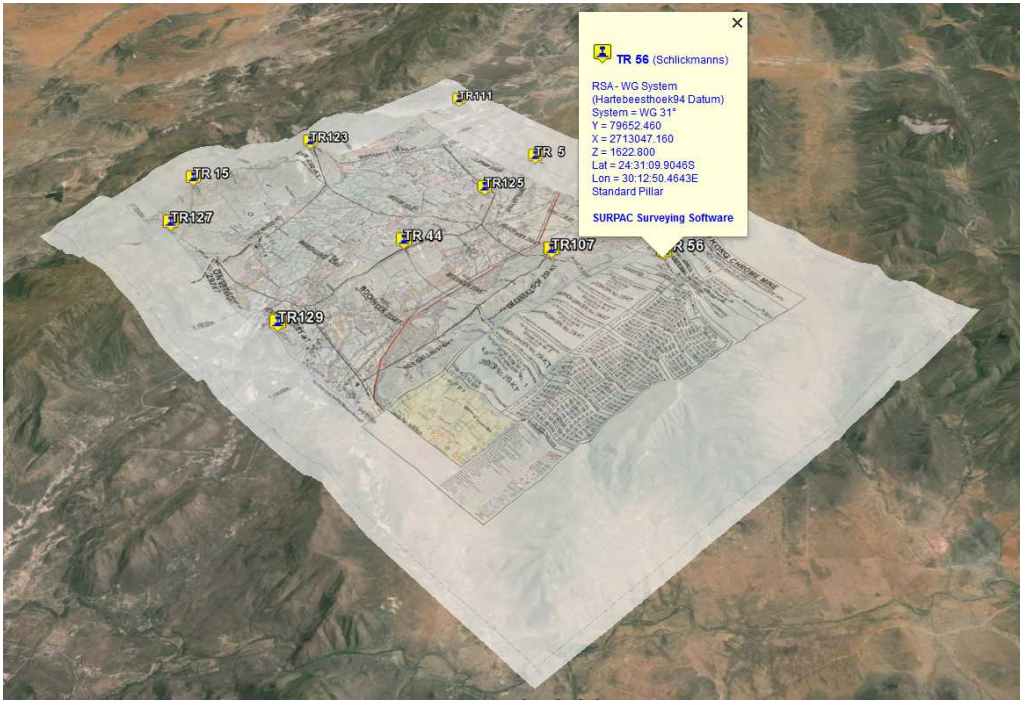
*The Sheet **Orientation** is always set to **True North** (regardless of the Sheet Swing used) and there is no **Tilt** applied. All view settings can be User modified from within **Google Earth**.*

*The Sheet overlay will be "locked" to the terrain covered by the Sheet. Hence, when viewed in **3D**, the Sheet will drape itself over the terrain. If the Sheet background has been set as fully transparent then only the Sheet data, such as Lines, Text, Hatching etc. will be shown. Otherwise, the **Slide** on the **Google Earth Sidebar** can be used to change the Sheet overlay transparency.*

Example of a SURPAC Township layout Sheet, with partial transparency, on Google Earth



A layout with full background transparency, on Google Earth



A 3D semi-transparent CAD Sheet Overlay, plus Trigs on Google Earth

File types used for Interfacing SURPAC with Google Earth

Interfacing with **Google Earth** is done via **KML** files (Keyhole Markup Language). **KML** files employ HTML/XML type grammar and may be used for modelling and storing geographic features such as points, lines, images, polygons and models for display in **Google Earth**, Google Maps, ESRI ArcGIS Explorer, AutoCAD etc.

Once you have defined which elements (points, lines, map sheets etc.) you want displayed on **Google Earth**, **SURPAC** will transform the **Y**, **X** (or **E**, **N**) positional information into **Latitudes** and **Longitudes**. **SURPAC** will also convert dotted or dashed lines into small line segments for sending to **Google Earth**, as the **KML** format can normally only handle solid lines.

If a **SURPAC CAD** sheet is to be sent to **Google Earth**, **SURPAC** will first set the sheet transparency, or set the background to fully transparent (as User set) and then create a **PNG** image of the sheet. *(**PNG** (Portable Network Graphics) files are lossless, highly compressed image files, normally having the extension of .png.)*

All **SURPAC** generated **KML** and **PNG** files are stored in the folder **"C:\Surpac_GE"**. The names of the generated **KML** files (and of the associated **PNG** files, where applicable) are :-

KML files saved from the **"Locate and Add Nearest Trig/TSM Beacons"** programme are called ***FileName_Trigs.kml***, where ***FileName*** is the name of the current **Co-ordinate** file.

KML files saved from the **"Co-ordinate File Editing"** programme are called ***PointName_Point_Group.kml***, where ***PointName*** is the name of the first Point selected (marked) in the current **Co-ordinate** file.

KML files saved for Lines and Points from the **"General CAD"** programme are called ***FileName_CAD_Lines.kml***, where ***FileName*** is the name of the current **Co-ordinate** file.

KML and **PNG** files saved for Sheet overlays from the **"General CAD"** programme are called ***FileName_CAD_Sheet.kml*** and ***FileName_CAD_Sheet.png***, where ***FileName*** is the name of the current **Co-ordinate** file.

KML files saved for Lines and Points from the **"General Plan"** programme are called ***FileName_GP_SheetX_Lines.kml***, where ***FileName*** is the name of the current **Co-ordinate** file and ***X*** is the current **GP** Sheet number.

KML and **PNG** files saved for Sheet overlays from the **"General Plan"** programme are called ***FileName_GP_SheetX.kml*** and ***FileName_GP_SheetX.png***, where ***FileName*** is the name of the current **Co-ordinate** file and ***X*** is the current **GP** Sheet number.

KML files saved for Lines and Points from the **"Working Plan"** programme are called ***FileName_WP_SheetX_Lines.kml***, where ***FileName*** is the name of the current **Co-ordinate** file and ***X*** is the current **WP** Sheet number.

KML and **PNG** files saved for Sheet overlays from the **"Working Plan"** programme are called ***FileName_WP_SheetX.kml*** and ***FileName_WP_SheetX.png***, where ***FileName*** is the name of the current **Co-ordinate** file and ***X*** is the current **WP** Sheet number.

KML and **PNG** files saved for Sheet overlays from the **"Contour CAD"** programme are called ***FileName_Contour_Sheet.kml*** and ***FileName_Contour_Sheet.png,*** where ***FileName*** is the name of the current **Contour** file.

Compressed (zipped) KMZ files for third party use

Another file format that can be used for sending data and overlays to **Google Earth** is the **KMZ** format. This is a zipped format of a **KML** file and is a handy format when sending overlay information to another person who does not have **SURPAC** Software.

To create a **KMZ** file from a **SURPAC** generated **KML** file, use any zip application, such as **Winzip**, or **WinRAR** to create a zipped file that contains all the required elements for the data and or overlay. The created zip file must be given the extension **.kmz**

Notes :-

1. *For files that contain **Points**, you must include the three small **PNG** image files called **RedBlackTrig.png**, **RedBlackTSM.png** and **RedBlackPoint.png**.These images are the **SURPAC** mark icons for Trigs, TSMs and Points respectively.*
2. *For overlays that consist of a **CAD** Sheet, the **PNG** image of the **CAD** Sheet must be included. The **PNG** image file will have the same name as the **KML** file.*
3. *All the above files, including the **KML** file, are located in the **"C:\Surpac_GE"** folder.*

The **KMZ** file can then be sent to a third party user, with the instruction that the contents of the **KMZ** file must be extracted to a folder called **"C:\Surpac_GE"**. Unzipping (extracting) the **KMZ** file will produce the parent file with a **KML** extension, plus the mark icons, and other information linked to the **KML** file. Double clicking on the extracted **KML** file will then open **Google Earth** and produce the same data and/or overlay view as produced by **SURPAC**.

Hints when using SURPAC CAD and Google Earth interfacing

1. *If you intend to view multiple **SURPAC** data and/or overlays in **Google Earth**, then do not close **Google Earth** after each viewing. Leave **Google Earth** in the background, or minimize it, whilst you generate the next view.*
2. *If you have multiple views displayed, any of these may be temporarily removed by un-checking their display names in the **Temporary Places** section.*
3. *When you do close **Google Earth**, you will be queried as to whether you want to save the temporary view in the **My Places** section. If you want the views to be permanent, then reply "Yes", otherwise they will be deleted.*

Importing a Google Earth Placemark into a Co-ordinate File

Creating a Placemark in Google Earth

In **Google Earth**, ensure that either the **Toolbar** or the **Sidebar** are displayed. Move the **Google Earth** display to show the required area at the required scale.

To create a **Placemark**, click the appropriate toolbar icon, or select the "**Placemark**" menu item found under the "**Add**" menu heading. The new **Placemark Dialog Box** appears and the cursor changes to a flashing, square drawing tool. Enter the properties for the **Placemark** and give it an appropriate **Name**. Since **SURPAC** will use the **Placemark Name** as the name for the imported Point, use a **SURPAC** friendly name, i.e. up to 8 characters in length.

Move the cursor onto the flashing drawing tool, and then drag the tool to the required screen position, by holding down the Mouse LHB as the cursor is moved. Once the drawing tool is correctly positioned, click the [**OK**] button on the dialog box. The newly created **Placemark** will be added to **My Places**. *(**Warning**, if you have a **Temporary Place** currently open at the time of the construction, then the **Placemark** may be added to that **Temporary Place**).*

The created **Placemark** now needs to be saved as a **KML** file in order for **SURPAC** to be able to import it. To do this, locate the **Placemark** under either **My Places** or **Temporary Places** and right click on it. A pop up menu will appear and on this menu click the **Save Place as …** menu item.

On the displayed **Save file …** form, ensure that the **Save as Type** item is set to **KML (*.kml)**. The **KML** file may be saved to any folder, but **SURPAC KML** files are generally kept in the **C:\Surpac_GE** folder. Finally**,** click on the [**Save**] button.

Importing the Placemark into a SURPAC Co-ordinate File as a Point

*Before attempting to import the **Placemark** data into a **Co-ordinate** file, first ensure that the file System is set to either the **WGS 84** or **GRS80** ellipsoids and that the Central Meridian of the WG System, or Zone, is correct for the Point data to be imported.*

In the **SURPAC Co-ordinate File Editing** programme, click on the [**Import GE KML**] button on the **Actions** bar menu.

From the displayed **File Selection** form, select the **KML** file that contains the required **Placemark** information. The **Placemark** position(s) will then be converted to its(their) equivalent **Y**, **X** (or **E**, **N**) co-ordinate values and

saved into the current **Co-ordinate** file, using the **Placemark** name(s) as the new Point name(s). If the **Placemark** does not contain a recognizable Name, **SURPAC** will use the default Names of KML1, KML2, ….. etc.

Transferring a Google Earth Path, Line or Polygon to a SURPAC General CAD Sheet

Creating a Path or Polygon in Google Earth

In **Google Earth**, ensure that either the **Toolbar** or **Sidebar** are displayed. Move the **Google Earth** display to show the required area at the required scale.

A **Path** may be a single **Line**, or a series of connected Lines. To create a **Polygon**, click the appropriate toolbar icon, or select either the **Path** or the **Polygon** menu item found under the **Add** menu heading. The new **Path** or new **Polygon Dialog Box** appears and the cursor changes to a square drawing tool. Enter the properties for your drawing and give the **Path** or **Polygon** an appropriate **Name**. You can change the style and/or colour for the **Path Lines** or **Polygon** from the default white to better visualize the shape you are about to draw. You can also enter an appropriate **Name** for the **Path** or **Polygon** to be created.

Click in the viewer to start the drawing creation and use the following method to achieve the desired shape :-

Regular shape - **Click and release method**. Move the Mouse to a new point and click to add additional points. In this mode, the cursor remains a square drawing tool whilst the **Path** or **Polygon** being drawn is displayed up to the last clicked position. **Polygons** will automatically be closed back onto the defined starting position. Whilst drawing, the last clicked position can be deleted by clicking the Mouse RHB.

Once construction of the **Path** or **Polygon** is complete, click the [**OK**] button on the dialogue box. The **Path** or **Polygon** created will be added to **My Places**. *(**Warning**, if you have a **Temporary Place** currently open at the time of the construction, then the **Path** or **Polygon** will be added to that **Temporary Place**).*

The created **Path** or **Polygon** information now needs to be saved as a **KML** file in order for **SURPAC** to be able to import it. To do this, locate the **Path** or **Polygon** under either **My Places** or **Temporary Places** and right click on it. A pop up menu will appear and on this menu click the **Save Places as …** menu item.

On the displayed **Save file …** form, ensure that the **Save as Type** item is set to **KML (*.kml)**. The **KML** file may be saved to any folder, but

SURPAC KML files are generally kept in the **C:\Surpac_GE** folder. Finally**,** click on the [**Save**] button.

Importing the Path or Polygon into a SURPAC General CAD Sheet

In the **SURPAC General CAD** programme first set the required **Layer**. **Pen Style**, and **Thickness** to be used for the imported **Lines**. Click on the **File** menu heading and then select the **Import Lines from Google Earth KML File** menu item . From the displayed **File Selection** form, select the required **KML** file. The **Lines** contained in the selected **KML** file will be imported and displayed on the current Sheet, using the defined **Layer**, **Style** and **Thickness**.

NB : *The same importation method can be used to import **Line** information from a **SURPAC** (and compatible) generated **KML** file containing **Lines** from sources such as other **General CAD Sheets**, **General Plans**, **Working Plans** and **Sectional Title Plans**.*

Transferring a Google Earth Image to the SURPAC General CAD

Creating an Image Bounding diagonal Line (Path) and defining an Image in Google Earth

In **Google Earth**, ensure that the **Toolbar** and **Sidebar** (found in the **Layers Panel**) are displayed. Move the **Google Earth** display to show the required area at the required scale.

Click the **Google Earth** "**Tools**" menu heading and select **Options…**. Select the **3D View** tag and then set the **Elevation Exaggeration** to **0.01.** *(This is important. If **Google Earth** is viewed using Elevations, images become distorted due to terrain height variations.)*

Use the **Navigation Control** (displayed at the top right corner of the **Google Earth** display) to set the orientation to **True North** (click the **N** symbol at the top of the **Navigation Control**). *(This is also important. If **Google Earth** is not viewed in **True North** orientation, the image will be distorted when sent to **SURPAC**.)*

Tips

*In order to be able to select the full image displayed, click on the Google Earth **View** menu and ensure that the **Status Bar** is not displayed.*

*To maximise the image area, click on the **Google Earth View** menu and ensure that the **Sidebar** is not displayed.*

With the **Google Earth** image oriented to **True North** and the **Elevation Exaggeration** to **0.01**, create a **Path** (as described above) consisting of a single line, by carefully clicking on the top left and then the bottom right corners of the **Google Earth** display area.

Save this **Path** as a **KML** file (as described above), normally into the **C:\Surpac_GE** folder.

NB : *After creating and saving this **Path**, it is important that the **Google Earth** display is not changed in any way until the current image has been saved.*

Click on **Google Earth**'s **File** menu heading, then select the **Save** menu item and then the **Save Image** sub-menu item. In the **Save As** dialogue box, enter an appropriate file **Name**. The file type is automatically set to the Jpeg format. Save the file in the same folder as the associated **Polygon** (normally the **C:\Surpac_GE** folder).

NB : *The **Google Earth Pro** application is able to create image files at a higher resolution than the standard **Google Earth**. However, the **Pro** version is not free and costs about US$400.*

Importing the Google Earth Image to a SURPAC General CAD Sheet

In the **SURPAC General CAD** programme ensure that the sheet size and scale are correct for the **Image** to be imported. Then import the **Image** bounding diagonal **line** via the **Path KML** file created above (which defines the **Image** size and position - see above) by using the **Import Lines from Google Earth KML File** menu item.

On the **CAD** Sheet, locate the cursor at the approximate centre of the **Polygon**, then click the Mouse RHB. Click the **Image** menu heading and then select the **Add (Import) a Sheet Image** menu item. On the **Image Selection** form, set the required path and then click on the required **Image** file. On the right hand side of the form *deselect* the **Maintain the Image Width and Height Ratio** option and *select* the **Apply Meridian Convergence to Image** option.

NB : *This last setting is important as it is necessary for **SURPAC** to apply a small rotation to the incoming **Image** to compensate for **Meridian Convergence**. This due to the **Google Earth Image** being oriented to **True North** and the **SURPAC** Image being oriented to the **Grid North** (i.e. the True North at the central meridian).*

The Sheet will then be automatically re-oriented by the amount of the Meridian Convergence. On the **SURPAC General CAD Sheet**, move the cursor to the top left terminal of the imported **Path** (or Line) and then click

the Mouse LHB. Now move the cursor to the bottom right terminal of the imported **Path** and then click the Mouse RHB.

SURPAC will now apply a swing to the **Image** to correct for the Meridian Convergence, as described above. The Sheet will again re-orientate back to 0° and display the adjusted imported **Image**.

NB : *The **Image** may not fit exactly onto the **Path** terminals, due to the former having been swung to compensate for the Meridian Convergence*

Adjusting the Imported Sheet Image

Setting the Image to the Background – If the **Image** lies on top of existing Line and Text items then set the **Image** as the background, i.e. the Lines, Text, Points etc. will be displayed on top of the **Image**. To do this, right Click on the **Image**, click the **Image** menu heading and then select the menu item **Send Images to the Back**.

Shifting the Image - The imported **Image** may need to be shifted in the **Y** and/or **X** directions to get a good fit with any existing Sheet data. If this is required, right Click on the **Image**, click the **Image** menu heading and then select the **Shift a Sheet Image** menu option. On the displayed form, enter the **Y** and/or **X** movement required for the **Image**. This option can be repeated to ensure a good fit.

Adjusting the Image Brightness and/or Contrast – **Images** required for background information may need their brightness and/or contrast adjusted to avoid the **Images** interfering with the display of Lines and Text. To do this, right Click on the **Image**, click the **Image** menu heading and then select either of the **Adjust Image Brightness** or the **Adjust Image Contrast** menu options. On the displayed form, use the slide bars to set the required brightness and contrast values.

SURPAC Google Earth Elevation Functions

These **SURPAC Google Earth** functions make use of the importation of height data interpolated via the **Google Earth Elevation API**. This function allows for the interpolation of heights of locations anywhere on the **Google Earth DTM**.

Summary

Based on tests carried out on data samples in areas in South Africa, it would appear that the interpolated **Google Earth** heights are, in general, accurate to about 3 - 4 metres. This figure can be improved to below the 2m level, however, by carrying out a comparison between surveyed ground heights and **Google Earth** derived heights for selected points in an area, and then adjusting the interpolated **Google Earth** heights for the mean area height difference. These results must be seen as estimates and might not be applicable in your area. This can best be tested by using ground control points for comparison. Nearby standard Trigonometrical Beacons can also be used for ground control (bear in mind that the Beacon height is the top of the pillar, which is usually 1.4m above ground level).

Applications

Generating Contour and DTM files via downloaded **Google Earth** data provides rapid and useful data that have various small scale applications. When displayed in conjunction with an imported **Google Earth** image, these become even more useful. The generated Contour and DTM files can also be exported as **KML** files for client viewing directly on **Google Earth** itself. Examples of useful applications are for :-

- Township planning approval
- Sub-divisional planning approval
- Preliminary water/gas/fuel pipe alignment over long distances
- Preliminary road/rail alignment over long distances
- Cross section data for preliminary mass haul calculations
- Preliminary dam site investigations (water volume versus wall height etc.)

1. Co-ordinate File Editing Programme

1.1 Import Points from a KML file – This existing function has been extended so as to allow the import of multiple Points contained in a **KML** file, and not just a single Point as was the case previously.

1.2 Importing interpolated Google Earth DTM Heights – This function allows you to import interpolated heights from **Google Earth** for any,

or all Points existing in the current Co-ordinate file. You may define the entire file, or mark (highlight) selected points in the file. Heights will only be imported for points whose current heights do not exist. Existing heights will not be overwritten.

Using this Option :
If you want to restrict the import of heights to selected Points, then first highlight these Points in the Co-ordinate file listing. You can highlight Points by :-

I. **Highlight a block of Points** by clicking on the first Point and then dragging the mouse cursor to the last required Point, or
II. **Highlight a block of Points** by clicking on the first Point and then, holding down the [**Shift**] keyboard key, click on last required Point.
III. **Highlight selected Points** by clicking on the first Point then, holding down the keyboard [**Ctrl**] key, click on any other Points required.

Then, in the **Actions** Menu, click on the **[File Options]** menu item to display the **File Options** form. The **Google Earth** options are at the bottom of this list of options. Click on **Import interpolated Google Earth Heights** and then click on the [**OK**] button. If you have highlighted a set of Points, you will be prompted if you want to restrict the height importation to these Points. Reply as appropriate.

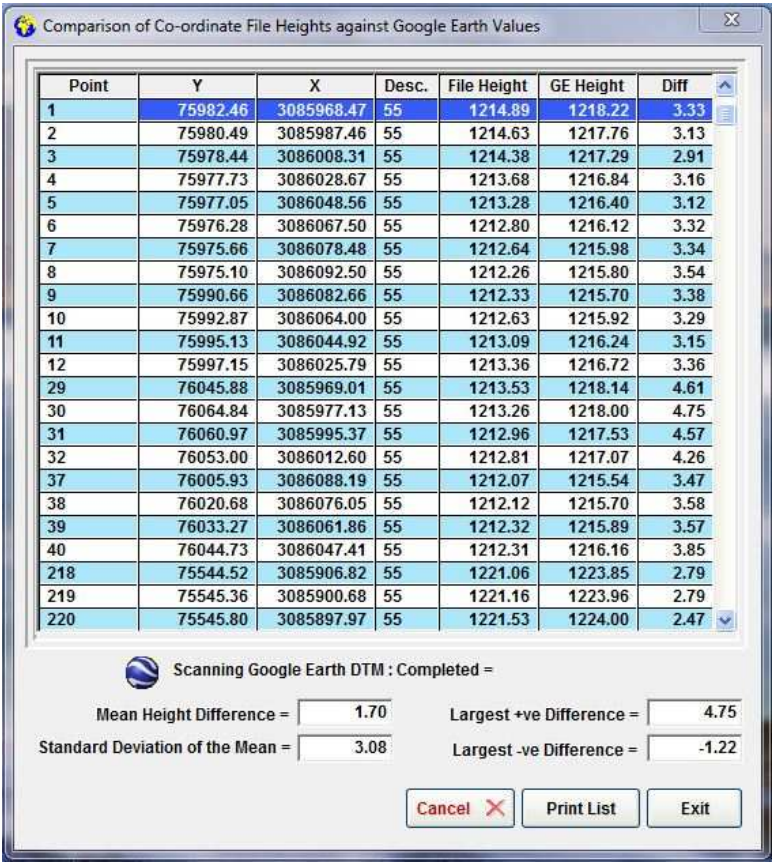
Heights for the selected Points, or for the entire file will now be imported via interpolation from the **Google Earth DTM** and displayed on the Co-ordinate file listing. These height importations are relatively slow and are imported at a rate of approximately 50-80 Point heights per minute, depending on your internet connection. speed. The maximum Point heights that may be imported are restricted by **Google Earth** to 2,500 per 24 hour period.

1.3 Compare Existing heights with interpolated Google Earth Heights

This function allows you to compare existing Co-ordinate file heights with interpolated heights from the **Google Earth DTM**. You can define the entire file, or mark selected points in the file. This function is useful when needing to evaluate the accuracy of imported **Google Earth** Heights against surveyed values.

Using this Option :
If you want to restrict the comparison of **Google Earth** heights to selected Points, then first highlight these Points in the Co-ordinate file listing as explained above. Then, in the **Actions** Menu, click on the **[File Options]** menu item to display the **File Options** form. Click on **Compare File and Google Earth Heights** and then click on the [**OK**]

button. If you have highlighted a set of Points, you will be prompted if you want to restrict the height importation to these Points. Reply as appropriate.


Comparison of Co-ordinate File Heights against Google Earth Values
Scanning Google Earth DTM : Completed =
Mean Height Difference = 1.70
Standard Deviation of the Mean = 3.08
Largest +ve Difference = 4.75
Largest -ve Difference = -1.22
Cancel
Print List
Exit

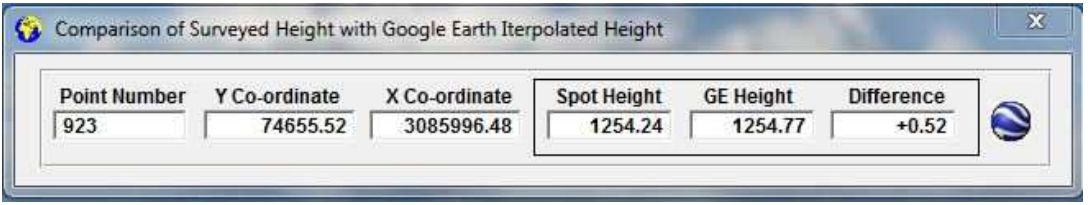
Point	Y	X	Desc.	File Height	GE Height	Diff
1	75982.46	3085968.47	55	1214.89	1218.22	3.33
2	75980.49	3085987.46	55	1214.63	1217.76	3.13
3	75978.44	3086008.31	55	1214.38	1217.29	2.91
4	75977.73	3086028.67	55	1213.68	1216.84	3.16
5	75977.05	3086048.56	55	1213.28	1216.40	3.12
6	75976.28	3086067.50	55	1212.80	1216.12	3.32
7	75975.66	3086078.48	55	1212.64	1215.98	3.34
8	75975.10	3086092.50	55	1212.26	1215.80	3.54
9	75990.66	3086082.66	55	1212.33	1215.70	3.38
10	75992.87	3086064.00	55	1212.63	1215.92	3.29
11	75995.13	3086044.92	55	1213.09	1216.24	3.15
12	75997.15	3086025.79	55	1213.36	1216.72	3.36
29	76045.88	3085969.01	55	1213.53	1218.14	4.61
30	76064.84	3085977.13	55	1213.26	1218.00	4.75
31	76060.97	3085995.37	55	1212.96	1217.53	4.57
32	76053.00	3086012.60	55	1212.81	1217.07	4.26
37	76005.93	3086088.19	55	1212.07	1215.54	3.47
38	76020.68	3086076.05	55	1212.12	1215.70	3.58
39	76033.27	3086061.86	55	1212.32	1215.89	3.57
40	76044.73	3086047.41	55	1212.31	1216.16	3.85
218	75544.52	3085906.82	55	1221.06	1223.85	2.79
219	75545.36	3085900.68	55	1221.16	1223.96	2.79
220	75545.80	3085897.97	55	1221.53	1224.00	2.47

A form will be displayed in which the selected Points, their co-ordinates, description, surveyed heights and interpolated **Google Earth** heights will be shown. These height comparisons are imported at a rate of approximately 350-500 Point heights per minute, depending on your internet connection. Statistical data relating to the comparison of heights are shown at the bottom of the form.

There is also an option whereby you can compare **Google Earth** heights for a single, User selected Point, i.e. :-

In the **Co-ordinate File** display, right click on the Point whose height you want to compare. On the "pop up" menu that will now be displayed, select the menu item **Compare Height with Google Earth**. A form will then be displayed showing the Point selected, its co-ordinates and height, the **Google Earth** height and the difference.

Moving the cursor away from this form will cause it to be removed.



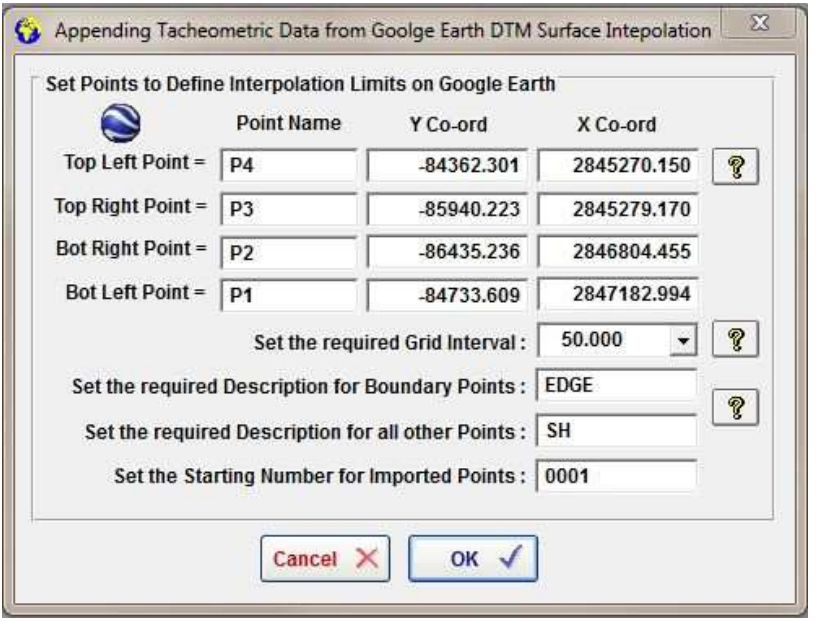
2. Tacheometric File Editing Programme

The main and most important function regarding the importation of **Google Earth DTM** data is the generation of **Tacheometric** files, using data solely imported via **Google Earth** interpolation, as explained below.

2.1 Import Points with interpolated Google Earth DTM Heights – This routine allows you to import Point co-ordinates, along with their interpolated heights, from the **Google Earth DTM**. Points are imported over a User defined quadrilateral figure covering the required area, plus a User defined Grid interval.

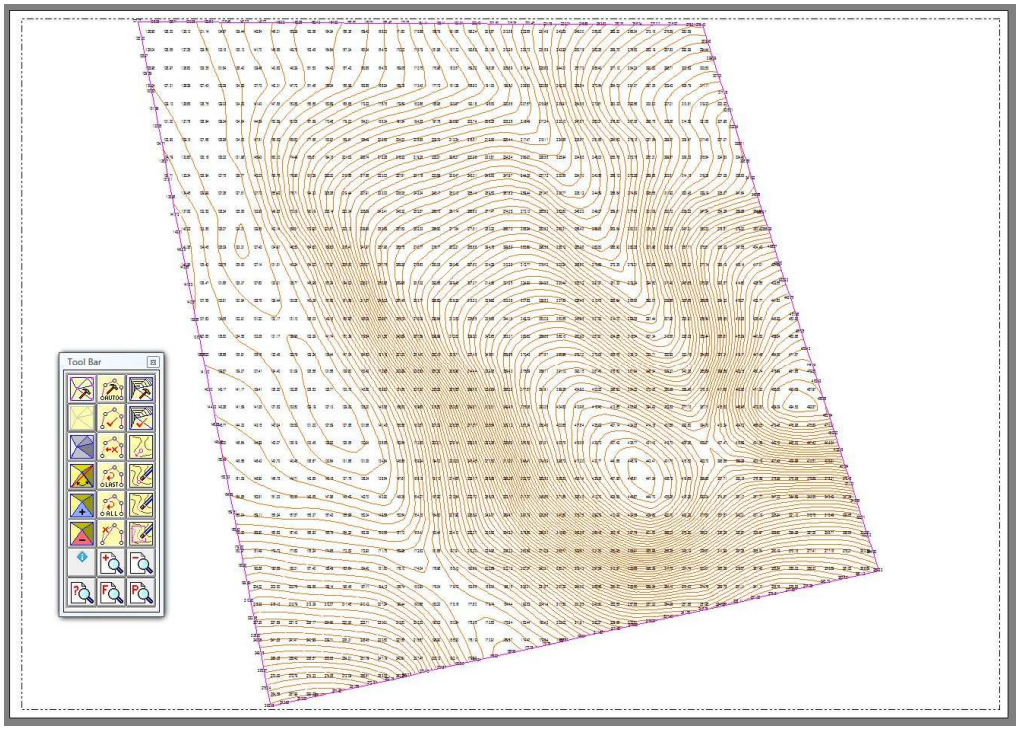
Using this Option :

In the **Actions** Menu, click on the **[Import GE Data]** menu item. The form below will be displayed, allowing you to enter the four points used to define the required quadrilateral. The named Points should exist in the current Coordinate file, otherwise their co-ordinates must be entered manually.


Appending Tacheometric Data from Goolge Earth DTM Surface Intepolation
Set Points to Define Interpolation Limits on Google Earth
Point Name
Y Co-ord
X Co-ord
Top Left Point = P4 -84362.301 2845270.150
Top Right Point = P3 -85940.223 2845279.170
Bot Right Point = P2 -86435.236 2846804.455
Bot Left Point = P1 -84733.609 2847182.994
Set the required Grid Interval : 50.000
Set the required Description for Boundary Points : EDGE
Set the required Description for all other Points : SH
Set the Starting Number for Imported Points : 0001
Cancel
OK

To ensure that the quadrilateral covers the correct area, these 4 Points are best determined by using **Google Earth** to create **Placemarks** at the appropriate positions. The quadrilateral does not have to be square, nor does it need to be oriented NS or EW. Any four Points that enclose the required area are sufficient. *One restriction is that, when entering the 4 Points into the above form, they must be entered in a clockwise sequence, normally starting at the Point that is approximately the NW corner.*

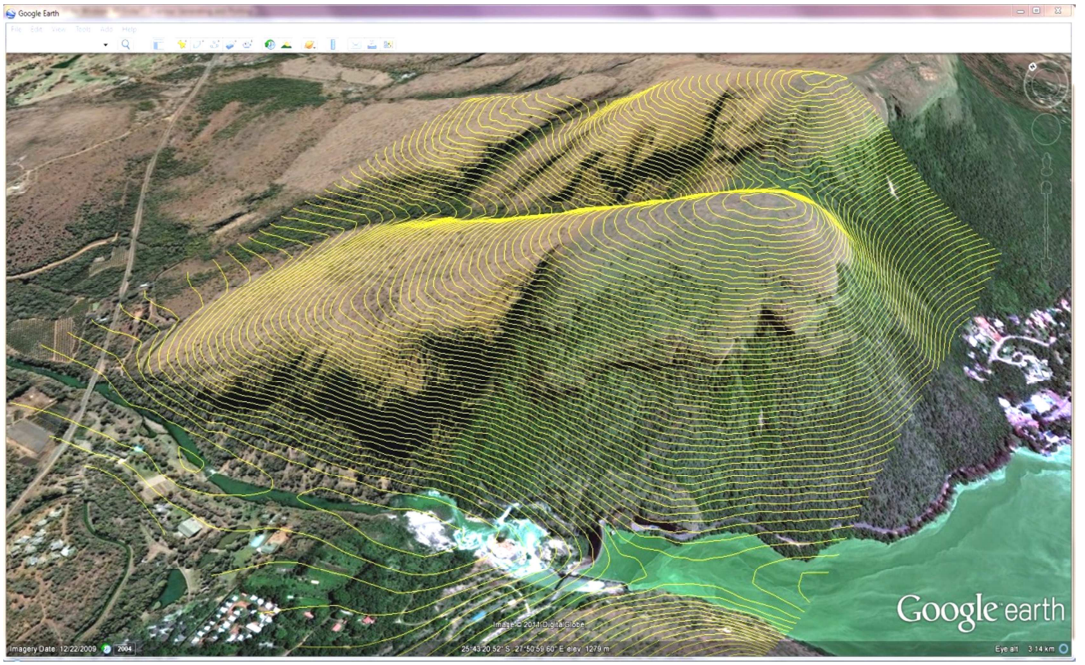
SURPAC will then proceed to calculate Tacheometric file points along the perimeter lines of the quadrilateral, as well as on all Grid intersections lying within the quadrilateral, using the defined Grid interval. Once all points are calculated, their heights are interpolated from **Google Earth** and all point data are added to the file. These Tacheometric points are imported at a rate of approximately 350-500 Points per minute, depending on your internet connection.



SURPAC Contour CAD, with imported Google Earth data on a 50m Grid

This generated **Tacheometric** file can then be used in the **SURPAC Contouring CAD** programme to construct and edit contour lines (using the Triangulation method) over the quadrilateral area, in the usual way.

The two preceding images and the following one show the stages of generating a contour display from imported **Google Earth** points, i.e. defining an area, importing the data, creating the Contours and then displaying these contours on **Google Earth** via a **KML** file.



SURPAC generated 5m Contours of Hartebeespoort dam wall area using Google Earth DTM heights

2.2 Compare Existing heights with interpolated Google Earth Heights

This function allows you to compare existing Tacheometric file heights with interpolated heights from the **Google Earth DTM**. .

This function is useful when needing to evaluate the accuracy of imported **Google Earth** Heights against surveyed values.

Using this Option :

In the **Actions** Menu, click on the **[Compare GE Hts]**. A form will be displayed in which the file Points, their co-ordinates, description surveyed heights and interpolated **Google Earth** heights will be shown. These height importations are imported at a rate of approximately 350-500 Point heights per minute, depending on your internet connection. Statistical data relating to the comparison of heights are shown at the bottom of the form.

3. Contour Generating CAD Programme

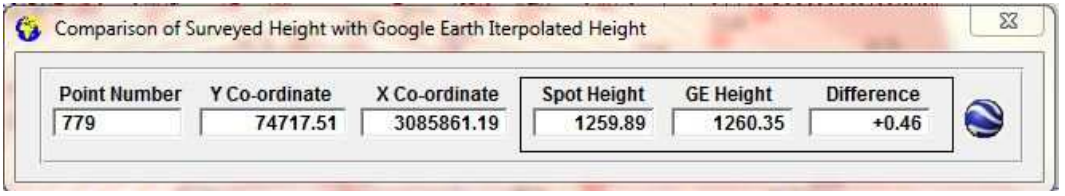
3.1 Compare existing heights with interpolated Google Earth Heights

This function is the same as that described **Tacheometric File Editing** Programme, above.

Using this Option :

3.1.1 Comparing a Single Point

Right click on the Spot Height that is to be compared and then, from the **Spot Heights** menu heading, select **Compare Spot Height with Google Earth Height** (for a single Point). A form will then be displayed showing the Point selected, its co-ordinates and height, the **Google Earth** height and the difference. Moving the cursor away from this form will cause it to be removed.



3.1.2 Comparing the entire file

Click on the **Spot Heights** menu heading and select **Compare Entire File with Google Earth** Heights. A form will be displayed in which the Tacheometric file Points, their co-ordinates, description, surveyed heights and interpolated **Google Earth** heights will be shown. These height comparisons are imported at a rate of approximately 350-500 Point heights per minute, depending on your internet connection. Statistical data relating to the comparison of heights are shown at the bottom of the form.

3.2 View 3D Contours & DTM on Google Earth

Once all the contours have been generated and edited, using the ***Surface Triangulation*** method, you can view the contours alone, or the contours and the solid 3D model created from the surface triangulation in situ on the **Google Earth** surface.

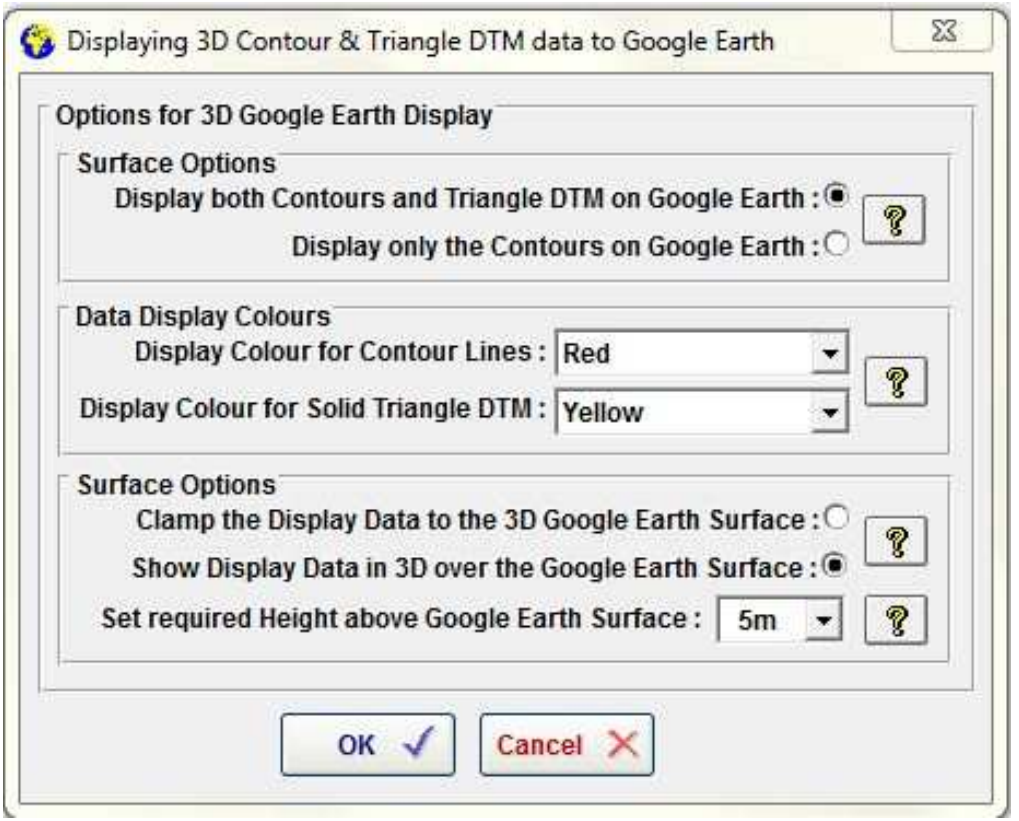
Using this Option :

Click on the **File** main menu heading and then select **View Contours & DTM on Google Earth** menu option.

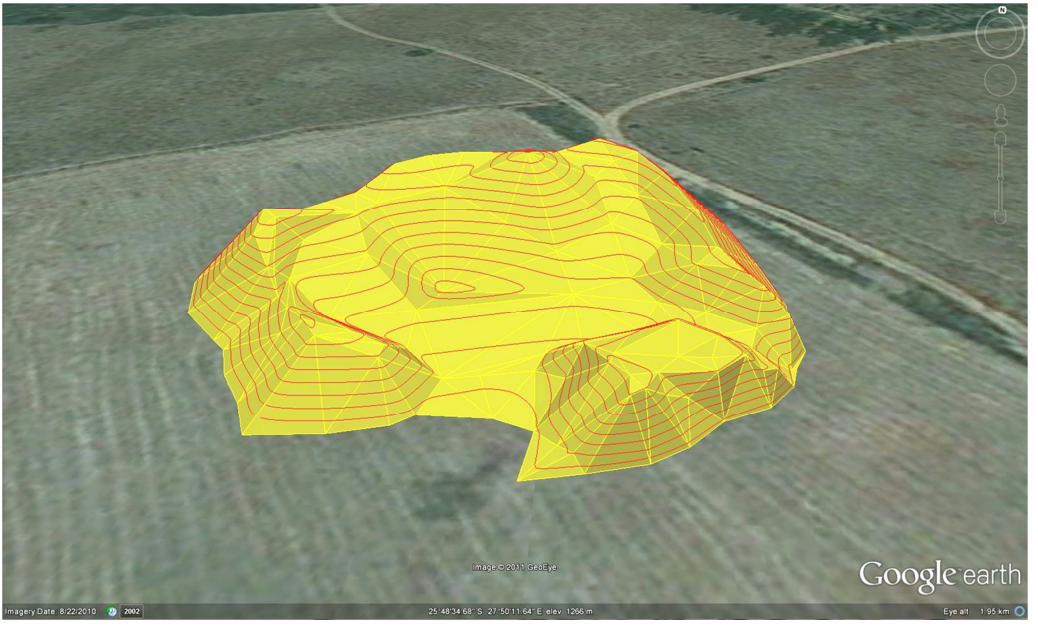
On the displayed form, first read the help information by clicking on the **[?]** icons, to see the implications and use of the available options, especially with regard to the two **Surface Options**. These options

allow for the display to be "clamped to the **Google Earth** " surface, or to have it shown as a free standing 3D model. The former method would be used for Contours that represent the natural earth surface and the latter for both Contours and DTMs of manmade features such as stockpiles, dumps and earthworks.

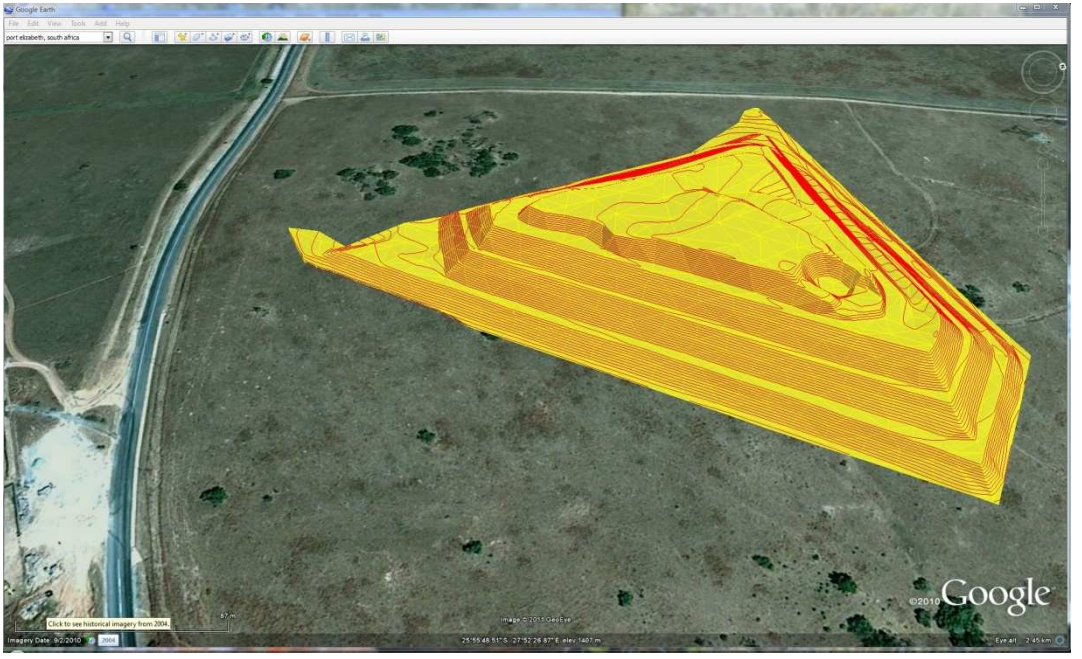
NB : ***Google Earth*** *will not display any imported* ***KML*** *data that lie below its own surface. Trying to display an excavation, for example, is not possible if the excavation Contours and DTM lie below the natural surface*.


Displaying 3D Contour & Triangle DTM data to Google Earth
Options for 3D Google Earth Display
Surface Options
Display both Contours and Triangle DTM on Google Earth :
Display only the Contours on Google Earth :
Data Display Colours
Display Colour for Contour Lines : Red
Display Colour for Solid Triangle DTM : Yellow
Surface Options
Clamp the Display Data to the 3D Google Earth Surface :
Show Display Data in 3D over the Google Earth Surface :
Set required Height above Google Earth Surface : 5m
OK
Cancel

Options for displaying Contours and/or DTMs on Google Earth



SURPAC 3D Triangulation Model and Contours displayed in situ on Google Earth


Google Earth
File Edit View Tools Add Help
port elizabeth, south africa
Click to see historical imagery from 2004.
Imagery Date 8/2/2010
2004
25°55'48.51" S 27°52'26.87" E elev 1407 m
Eye alt 2.45 km
©2010 Google

SURPAC 3DTriangulation Model and Contours of a slimes dam survey

In the first example on the previous page, the "*Show Display in 3D over the Google Earth Surface*" was used. This mode is necessary for physical manmade features, such as dumps or stockpiles, that overlay the pre-existing natural surface.

Summary on displaying 3D Models on Google Earth

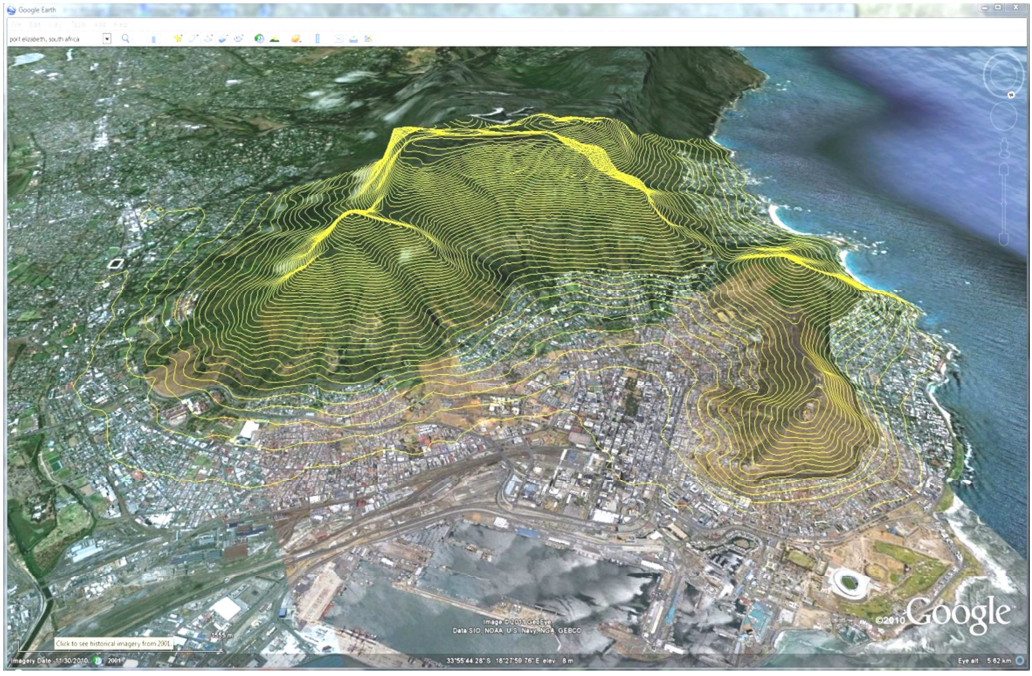
*In **Google Earth** it is possible to view imported and superimposed **KML** data from various view ports. This can be done dynamically using the Mouse, as follows :-*

- ***Panning** – Hold down the Mouse Left Hand button and move the cursor in the desired direction.*
- ***Scaling** – Scroll the mouse scroll wheel forwards or backwards.*
- ***3D Object Viewing** – Move the cursor to the centre of the object, then hold down the Mouse Middle button. Moving the cursor forwards or backwards will change the Tilt (vertical) view point. Moving the cursor left or right will change the Orientation (horizontal) view point. The amount of vertical height exaggeration can be set in **Google Earth** by clicking on the **Tools** menu and selecting the **Options…** menu item.*

The following image of Table Mountain shows superimposed 20m contours, generated in **SURPAC** from **data** imported from the **Google Earth DTM**. The **KML** display uses the "Clamp to **Google** Earth Surface" option. As this covers a large area and a large number of points (a 50m grid was used), the data had to be imported in two sessions.

Google Earth will only allow the downloading of 2,500 "locations" per user per day. As **SURPAC** collects data at a rate of 4 points per "location", this maximum daily limit is increased to 10,000 points.

For areas that require more than this limit, separate the area into two or more sections and download the data on consecutive days (or just use a different e-mail addresses if you have them!)



SURPAC 20m Contours of Table Mountain using imported Google Earth DTM heights

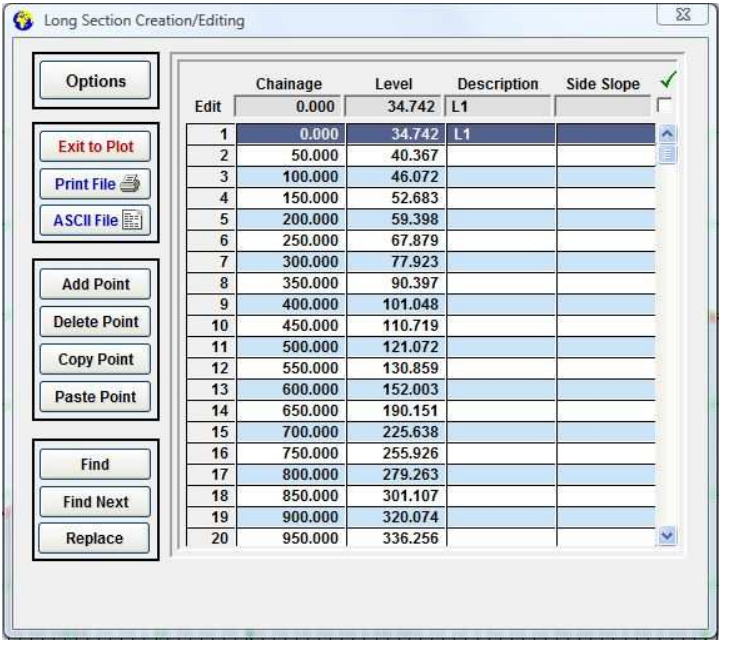
4. Longitudinal Sectioning Programme

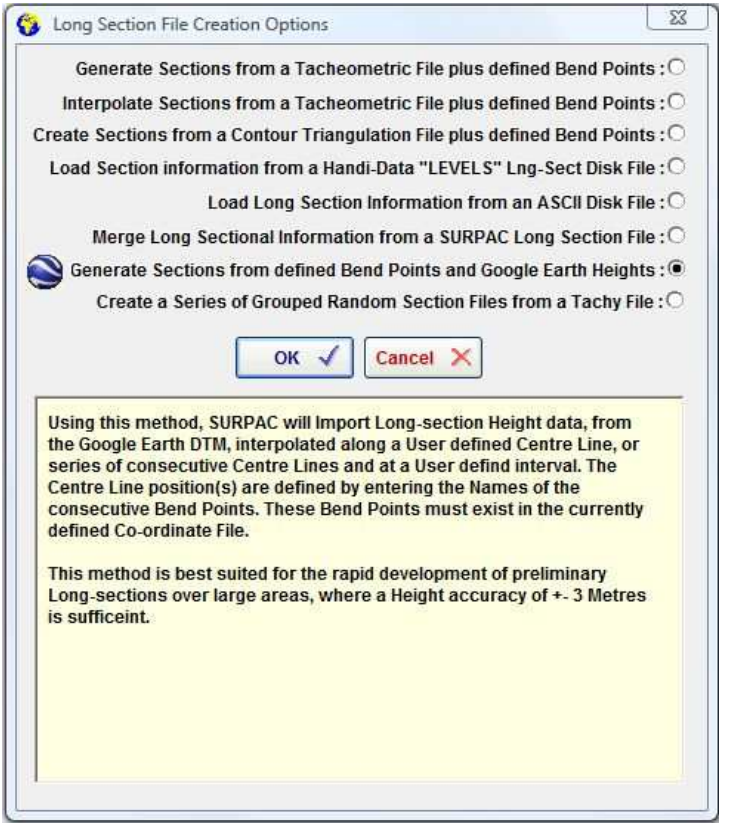
This function allows for the generation of Longitudinal Sections by the direct importation of interpolated **Google Earth DTM** Heights.

Using this Option :
Click on the [**Set File Type**] menu item in the **Actions** Bar menu. On the displayed form, select the "**Section Plotting Using a LONG-SECTION File only**" option and Click the [**OK**] button.

Click on the [**Select a File**] menu item in the **Actions** Bar menu. From the displayed form, enter the new **File Name** and Click on the [**Open**] button.

Once the "**Long Section Creation/Editing**" form is displayed, Click on the [**Options**] button. From the displayed list, select the "**Generate Sections from defined Bend Points and Google Earth Heights**" option and then Click the [**OK**] button.

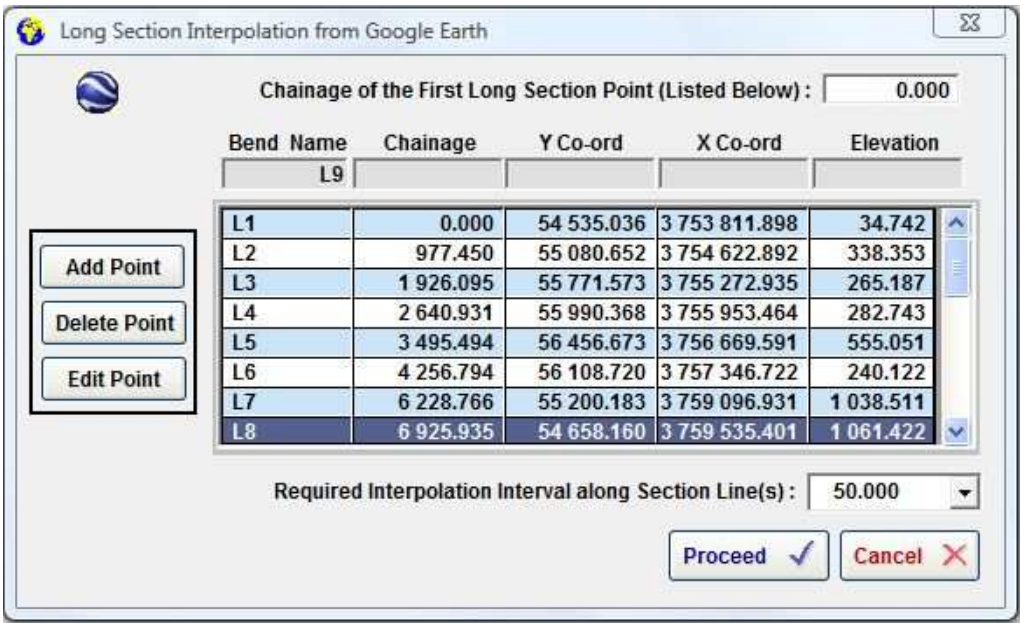

Long Section Creation/Editing
Options
Exit to Plot
Print File
ASCII File
Add Point
Delete Point
Copy Point
Paste Point
Find
Find Next
Replace
Edit
Chainage
Level
Description
Side Slope
0.000
34.742
L1
1 0.000 34.742 L1
2 50.000 40.367
3 100.000 46.072
4 150.000 52.683
5 200.000 59.398
6 250.000 67.879
7 300.000 77.923
8 350.000 90.397
9 400.000 101.048
10 450.000 110.719
11 500.000 121.072
12 550.000 130.859
13 600.000 152.003
14 650.000 190.151
15 700.000 225.638
16 750.000 255.926
17 800.000 279.263
18 850.000 301.107
19 900.000 320.074
20 950.000 336.256


Long Section File Creation Options
Generate Sections from a Tacheometric File plus defined Bend Points :
Interpolate Sections from a Tacheometric File plus defined Bend Points :
Create Sections from a Contour Triangulation File plus defined Bend Points :
Load Section information from a Handi-Data "LEVELS" Lng-Sect Disk File :
Load Long Section Information from an ASCII Disk File :
Merge Long Sectional Information from a SURPAC Long Section File :
Generate Sections from defined Bend Points and Google Earth Heights :
Create a Series of Grouped Random Section Files from a Tachy File :
OK
Cancel
Using this method, SURPAC will Import Long-section Height data, from the Google Earth DTM, interpolated along a User defined Centre Line, or series of consecutive Centre Lines and at a User defind interval. The Centre Line position(s) are defined by entering the Names of the consecutive Bend Points. These Bend Points must exist in the currently defined Co-ordinate File.
This method is best suited for the rapid development of preliminary Long-sections over large areas, where a Height accuracy of +- 3 Metres is sufficeint.

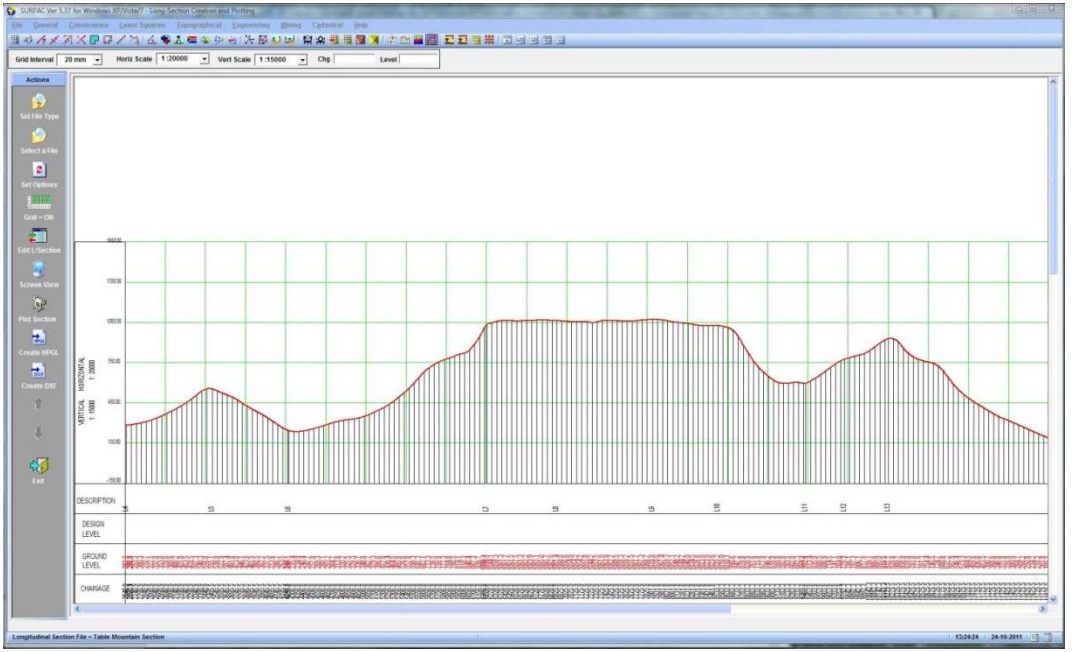
A form will then be displayed that allows you to enter the **Bend Points** that define the Required **Long. Section**. These Points must exist in the current **Co-ordinate File**.

NB : *An easy way to import a series of **Bend Points** is to define a **Path** in **Google Earth** that follows the required route. This **Path** can then be imported into the **SURPAC General CAD** programme. After this, use the option that **Converts Line terminals into Points**.*

*The [Y, X] values of these Points will then be stored in the Co-ordinate File. Finally, use the Co-ordinate File's "**Import interpolated Google Earth Heights**" option to height these **Bend Points**.*



Once all **Bend Points** have been entered, select the required **Interpolation Interval** for the section and then Click the [**Proceed**] button.



A SURPAC Long Section through Lion's Head, Table Mountain and Devil's Peak, using a Path and Heights imported from Google Earth

Creating KML Placemarks & Polygons with linked Images/Files

SURPAC is able to create **Google Earth KML** files for both **Placemarks** and **Polygons** that have attached Images or, Files, or both. When the **Placemark** or **Polygon** is displayed on **Google Earth**, clicking on its icon will display locality information, hypertext Links to files and the Images included for the Placemark, or Polygon.

The **Image Placemarks** (this wording is used to differentiate form standard Placemarks) are created via the **Co-ordinate File Editing** programme, and the **Image Polygons** (again to differentiate from standard Polygons) are created via the **General CAD** programme. Both programmes are found under the **SURPAC General** main menu heading.

Image Placemarks can be useful for :-

- Defining the Point's position on the earth's surface.
- Using an image or a sketch plan to clearly show the physical location of a Beacon, Reference Mark, Trig. Beacon or Town Survey Mark.
- Using an image to display a surveyed point of interest, such as a monument, grave stone, sewer or geographical feature.
- Using a Link file to describe an important surveyed feature or point of interest.

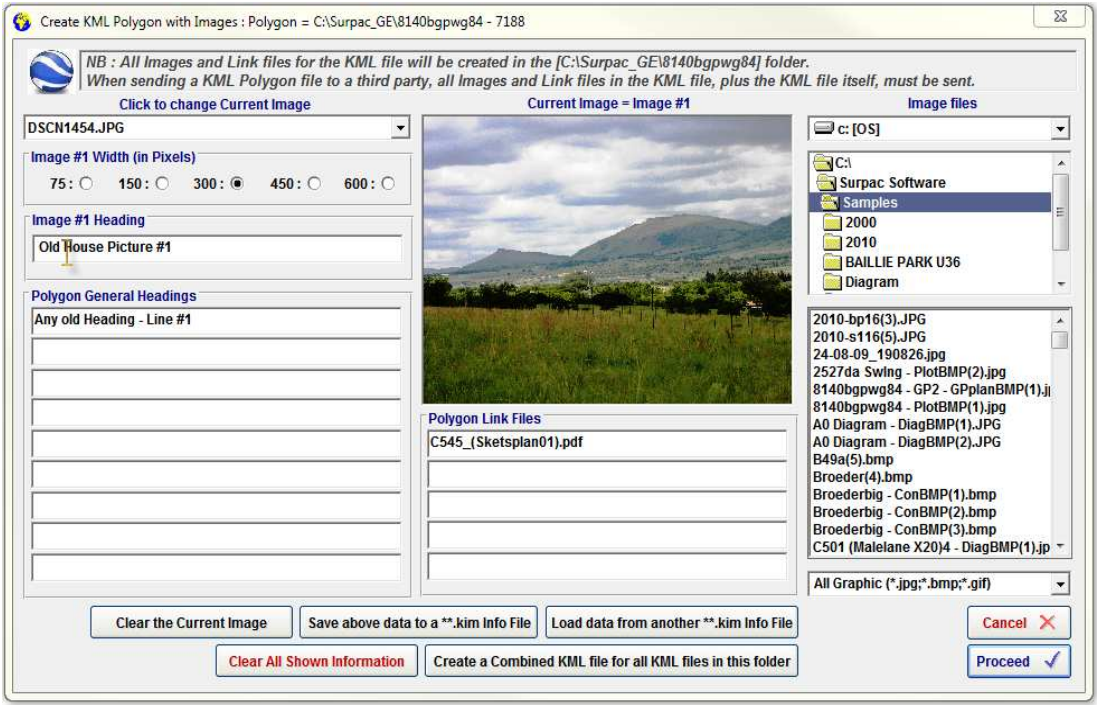
Image Polygons can be useful for :-

- Defining the position, shape and size of the Polygon on the earth's surface.
- Showing images of site itself from various viewing positions.
- Showing images of important geographical features on the site.
- Showing images of existing infrastructure or development on the site.
- Using Link files defining the Polygon/site dimensions and legal documents pertaining to the site, such as a Diagram or Deed of Transfer etc.

Although the **KML** files for both **Image Placemarks** and **Image Polygons** are created individually, all such files in a folder can be combined into a single **KML** file. Sending the information to a third party, then requires just sending the sub-folder (see below) created by **SURPAC**, as this sub-folder will contain all the necessary **KML** files (including the combined **KML** file), as well as the image and link files used in each of the **KML** files.

Creating KML Image Placemarks in SURPAC

When in the **Co-ordinate File Editing** programme, right click on the display line for the **Point** for which an **Image Placemark** is to be created. This will cause the normal pop up menu to be displayed, which now includes the new menu item **Create a Google Earth Image Placemark**.


Create KML Polygon with Images : Polygon = C:\Surpac_GE\8140bgpwg84 - 7188
NB : All Images and Link files for the KML file will be created in the [C:\Surpac_GE\8140bgpwg84] folder.
When sending a KML Polygon file to a third party, all Images and Link files in the KML file, plus the KML file itself, must be sent.
Click to change Current Image
Current Image = Image #1
Image files
DSCN1454.JPG
c: [OS]
Image #1 Width (in Pixels)
75 : 150 : 300 : 450 : 600 :
Image #1 Heading
Old House Picture #1
Polygon General Headings
Any old Heading - Line #1
C:\
Surpac Software
Samples
2000
2010
BAILLIE PARK U36
Diagram
2010-bp16(3).JPG
2010-s116(5).JPG
24-08-09_190826.jpg
2527da Swing - PlotBMP(2).jpg
8140bgpwg84 - GP2 - GPplanBMP(1).j
8140bgpwg84 - PlotBMP(1).jpg
A0 Diagram - DiagBMP(1).JPG
A0 Diagram - DiagBMP(2).JPG
B49a(5).bmp
Broeder(4).bmp
Broederbig - ConBMP(1).bmp
Broederbig - ConBMP(2).bmp
Broederbig - ConBMP(3).bmp
C501 (Malelane X20)4 - DiagBMP(1).jp
Polygon Link Files
C545_(Sketsplan01).pdf
All Graphic (*.jpg;*.bmp;*.gif)
Clear the Current Image
Save above data to a **.kim Info File
Load data from another **.kim Info File
Cancel
Clear All Shown Information
Create a Combined KML file for all KML files in this folder
Proceed

Set up form for a Google Earth Image Placemark or Image Polygon

The above form will be displayed, with its heading showing the folder Path that will be used to store the **Image Placemark**/**Polygon** information and the Point or Polygon **Name**.

NB : ***SURPAC*** *will create a sub-folder under the main* ***SURPAC - Google Earth*** *folder (called "****C:\Surpac_GE****"). This sub-folder is created from the name of the current Co-ordinate file. All blanks in the file name will be replaced by underscores. In the above example, the folder used to store the information is "****C:\Surpac_GE\8140bgpwg84****", and the Polygon name is* ***7188****.*

Entering Image File, Link file and Headings for an Image Placemark or Image Polygon

Image Files : The top, left hand drop down box, under the heading **Click to Change Current Image**, selects the current Image holder. You are able to select up to 8 Images for an Image Placemark or Image Polygon. The **File** selection box, on the right hand side of the form, will display all acceptable **Images** in the current folder path. The folder path can be changed by selecting the required path, using the **Drive** and **Directory** selection boxes above the file display. The **Image** type displayed can be selected using the file **Type** selection box below the file display.

***NB** : The only **Image** file types that may be used are **JPEG** (*.jpg), **Bitmap** (*.bmp) or **GIF** (*.gif) files.*

Clicking on a file Name in the File selection box will display the image in the image holder at the top centre of the form. To select this file as the Image for the Current Image, double click on the file Name.

Image File Headings : Each Image used for an Image Placemark or Image Polygon can have its own Heading. For example, for Image #1, position the cursor in the input box, directly below the heading **Image #1 Heading**, enter the heading required for that **Image**. Repeat this for all **Images** that are used.

Image Sizes : You can set the size of each Image included in the Placemark, or Polygon KML file. Image width values may be selected from 75 pixels up to 600 pixels. The default value is 300 pixels. These are the sizes of the Images that will be shown when you click on a Placemark, or Polygon in **Google Earth**. The actual size of the Image itself is not changed. Once in **Google Earth**, you can right Click on a displayed Image in order to display it full size.

Placemark or Polygon General Headings : At the bottom left of the form are input boxes for up to 9 **General Headings**. These headings may be used for any descriptive purpose to help describe the purpose, locality etc. of the Image Placemark or Image Polygon. These headings may be entered, edited or removed in the usual way.

Placemark or Polygon Link Files : A **Link File** is a file that the Image Placemark or Image Polygon can load up and display within **Google Earth** via a hyperlink text item.

***NB** : Link Files have to be **Printer Document** files (**.pdf) or standard **ASCII** files (*.txt).*

The input boxes directly below the heading **Placemark Link Files**, or **Polygon Link Files**, at the bottom centre of the form allow for the selection of up to 5 Link Files.

***NB** : For **Image Polygons**, **SURPAC** automatically generates and adds a text file that contains the Polygon Points system co-ordinates, geographical co-ordinates, the distances and directions, between Points and the Polygon Area. This file will automatically be included in the **KML** file's list of hyperlink **Link Files**. The file will not be shown on the above form, but the hyperlink will be visible as a part of the KML file information in **Google Earth**.*

On clicking on any of the available 5 input boxes for **Link Files**, The file selection box, on the right hand side of the form, will display all ***.pdf** and ***.txt** files in the current folder path. The folder path can be changed by selecting the required path, using the **Drive** and **Directory** selection boxes above the file display. The **Link File** type displayed can be selected using the file **Type** selection box below the file display.

Double Click on a file Name in the **File** selection box to select this file as a **Link File**. The file's name will appear in the selected **Link File** input box.

[Clear the Current Image] Button : This button will clear the currently displayed **Image**. Only use this option if you want the current **Image** to remain blank (unused). If you just want to change the existing Image for another **Image**, simply re-select a new **Image** as described above.

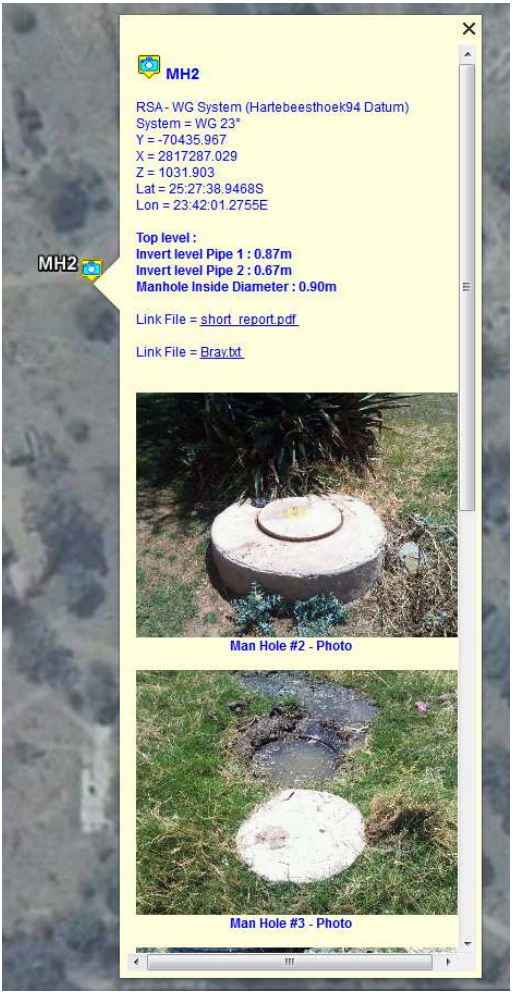
[Clear All Shown **Information] Button** : This button will clear all the currently displayed **Images**, **Link** Files and **Headings**. Use with caution. A warning message will be displayed in case you Click this button in error.

[Save above Data to a *.kim Info File] Button** : This button allows for the intermediate saving of the information to a ***.kim** file. A ***.kim** file is a **SURPAC** file that holds all data for an Image Placemark or Image Polygon. The ***.kim** file saved will be in the sub-folder of the "**C:\Surpac_GE**" (as explained above) and will have a name associated with current Placemark or Polygon. In the above example, the path and file name will be :-

C:\Surpac_GE\L5952_(Youngsville_Township)_(Wg_27)\ 13B - KML Image Placemark.kim

[Load data from another **.kim Info File] Button : When running this programme, it will check to see if the current Placemark, or Polygon has an existing **.kim file. If so, it will automatically load data for this Placemark, or Polygon. However, it can be useful to load, or Import data from another *.kim file. For example, if you have a large number of Placemarks to create and all Placemarks have the same, or similar Headings, then you can import these Heading and any other common information into a new Placemark, or Polygon. These data can then be edited as required.

[Create a Combined KML file for all KML files in the folder] Button : After the completion of all required Image Placemarks, or Image Polygons, the **KML** files for these items can be combined into a single **KML** file. This file will contain all the **KML** information for the Image Placemarks, or Image Polygons, in the current sub-folder.



This is a convenient way of displaying all Placemarks, or Polygons, on **Google Earth** by using a single command, especially if you intend sending the information to a third party. These files will have the name This is a convenient way of displaying all Placemarks, or Polygons, on **Google Earth** by using a single command, especially if you intend sending the information to a third party. These files will have the name **Combined_Image_PlaceMarks**, or **Combined_Image_Polygons**.

Sending Placemark or Polygon KML files to a third party

When sending a **KML** file to a third party, you must include all the **Image Files** and **Link Files** with the **KML** file. If you have created a Combined **KML** file, then safest way to do this is to include all files in the sub-folder.

If you are sending **Placemarks** you must include the small file called "**Camera5.gif**" in order to get the correct symbol shown on **Google Earth**.

Displaying an Image Placemark KML on Google Earth

Once a **Placemark** has been created, **SURPAC** will transfer the **KML** file **Google Earth** (assuming that **Google Earth** has been installed). You should see the Placemark represented by a camera location (to differentiate it from a standard Placemark that has no Image attachments). To display the Placemark's Name, co-ordinates, headings, Link Files and Image Files, Click on the icon.

To display the contents of a hyperlink **Link Files**, right Click on the hyperlink. **Google Earth** will then switch to its display page and display the contents of the file. If the file does not display and the loading bar stays on the form, then just click the refresh button at the top of the screen.

To display the Images in full size, right Click on the Image. **Google Earth** will then switch to its display page and display the Image.

The **Google Earth** icon used by **SURPAC** Software for **Image Placemarks** and **Image Polygons** is :-

- Image Placemarks or Polygons

Creating KML Image Polygons in SURPAC

Image polygons are created using the **General CAD** programme (found under the **General** Menu heading).

When in the **General CAD** programme, move the mouse cursor inside the figure/stand/polygon for which you want to create an **Image Polygon** on **Google Earth**. Then right Click the mouse. The cursor will move up into the Menu area. Now Click the **Figure** menu heading and then, from the drop down menu, select the option **Create a Google Earth Image Polygon**. **NB** : The keyboard equivalent command is [**FG**]. With the cursor inside the required figure/stand/polygon, type in **FG**

You will now be prompted to enter the Number or Name for the figure/stand/polygon. The programme will then for search and locate the Lines that form the figure/stand/polygon. These Lines will be displayed in purple. If the incorrect Lines are selected, then cancel the routine

The form for selecting **Image Files**, **Headings**, **Link Files** etc. will be displayed If the incorrect Lines figure/stand/polygon have been selected, then cancel the routine and retry.

Refer to the above explanations on how to select information for the **Image Polygon KML** and how to create a **Combined_Image_Polygon KML**.

Displaying an Image Polygon KML on Google Earth : Once an Image Polygon has been created, **SURPAC** will transfer the **KML** file **Google Earth** (assuming that **Google Earth** has been installed). You should see the figure/stand/polygon shown on **Google Earth** as a half-transparent cyan polygon. To display the Polygon's Name/Number, headings, Link Files and Image Files, Click anywhere inside this displayed polygon.

NB : *The hyperlink **Link File** called *******_-_Data_File.txt** (where ***** is the given Name/Number for the Image Polygon) will automatically be included in the list of **Link Files**. This **Link File** consists of **System** and **Geographical co-ordinates** for all the polygon points, plus the polygon **area**.*

To display the contents of a hyperlink **Link Files**, right Click on the hyperlink. **Google Earth** will then switch to its display page and display the contents of the file. If the file does not display and the loading bar stays on the form, then just click the refresh button at the top of the screen.

To display an Image in full size, right Click on the Image. **Google Earth** will then switch to its display page and display the full size Image.

7160
Surveying Instruments in the 20th century
A photographic Collection of old Instruments
Polygon Info File = 7160 - Data File.txt
1920 Hilger & Watts Vernier Theodolite
1940 Cooke, Toughton $ Simms - Tilting Level

Creating Hatched (filled) Polygons for Exporting to Google Earth

The previous section explains how it is possible to set up a **Hatched Image Polygon** in the **General CAD** programme, used for creating a **KML** file and exporting this to **Google Earth**. This same routine may be used for creating standard **Hatched Polygons** (without any image or document attachments) as follows :-

In the **SURPAC General CAD** programme, Click the **Hatch/Flood** menu heading and then select the menu items to set the required **Hatch Colour** and **Hatch Type** and then **Hatch** the selected **Polygon**.

From the **File** menu heading, select the item **Create a KML Google Earth Image Polygon**. Enter the required **Name** for the **Polygon** and, when the **Image and Link** file option form is displayed, just Click on the **[Proceed]** button without entering any link information.

Google Earth display of a Hatched (filled) Polygon from the SURPAC General CAD programme

Locating and Adding the Nearest Bench Marks (RSA only)

Bench Marks in South Africa and their use in SURPAC Software

The office of **National Geo-spatial Information** (within the Department of Rural Development and Land Reform) has issued a list of **Bench Marks** covering the Republic of South Africa. The **Bench Mark** heights (Orthometric heights) were determined using precise levelling and they represent the most accurate height reference system for relating surveys to the South African reference geoid.

It is long been common practise for Surveyors to determine a height reference for a survey by means of Trigonometrical levelling from national Trig beacons. Whilst, in general, there is nothing wrong with this technique, Surveyors should be aware that in some areas of the country there are height deviations between the Trig heights and the **Bench Mark** heights of up to several metres.

For Surveyors who want to connect their surveys to the national **Bench Mark** system, **SURPAC** now provides a programme that locates and displays the nearest **Bench Marks** to the survey area and allows the loading of User selected **Bench Marks** into the current Co-ordinate file.

Currently, this programme is limited to the geographical area of the **Republic of South Africa**, and to surveys whose co-ordinate system is defined as being in the "**WG**" (WGS 84 Ellipsoid) System (in South Africa, the "**Hartebeesthoek94 Datum**").

It is not necessary for the User to define any source file for the location of the **Bench Marks** as **SURPAC** has a built in Source file called "**BenchMarksRSA.sbm**". This file must exist in the folder in which **SURPAC** Software is installed (usually the folder "**C:\Surpac Software**").

The above Source file contains the double precision geographical positions (Latitude and Longitude) of about 18,000 **Bench Marks** throughout the Republic of South Africa, approximately co-ordinated in the "**Hartebeesthoek94 Datum**" system.

This programme will automatically search and extract the required **Bench Mark** information from the above Source file.

Since the Source file **Bench Marks** are stored in [**Lat**, **Long**] format, any Degree Square boundaries become irrelevant to the programme. Surveys can be located close to any Degree Square boundary, and the programme will still generate its own, temporary "Degree Square" of Points, centered about the

Survey, or any defined Point in the Survey. Data may be drawn from different Degree Squares for any given Survey.

The programme offers User options for both the selection of **Bench Marks**, and the display mode used, namely :-

- The **Search Centre position** may be User selected,
- The **number of located Bench Marks** displayed may be set according to a required **maximum number**, or a required **maximum search radius**,
- The **display of located Bench Marks** may be in order of **Distance**, **Direction** or **Point Name** or **Height Difference** (If the **Google Earth DTM** height values are displayed).
- Any of the **located Bench Marks** in the displayed list may be tagged as "**not required**", to prevent them from being added to the Co-ordinate file, or displayed on **Google Earth**.
- Located **Bench Marks** in the displayed list will have their **Degree Square** values shown.
- An **output** of the displayed list of located **Bench Marks** may be made to the **Printer**, an **ASCII** file, an **Excel** file or the **Clipboard**.
- The **located Bench Marks** in the displayed list, marked as "**required**" (i.e. the selected **Bench Marks**) may be **added** to the current **Co-ordinate File**.
- The list of **Bench Marks** may also be displayed on **Google Earth**.

The **Google Earth DTM** may also be used to import and display the **Google Earth** heights of the located **Bench Marks**. In this case, the differences between the actual **Bench Mark** heights and their **Google Earth DTM** values will be displayed. These height differences may be used to adjust (raise or lower) a set of imported grid heights from the **Google Earth DTM**, for contouring purposes.

The **Bench Mark** Y, X co-ordinates are those supplied by the **NGI** and, unfortunately, their positions are only approximate, having an accuracy in the order of only ± 15 metres. We have requested from the **NGI** images of the locality sketches that could then be attached to a **KML** display of a set of **Bench Marks**. This would make the location of the **Bench Marks** in the field a lot simpler. As yet, we have had no response to this request from the **NGI**. Hopefully, we will be able to add this feature at a later date.

Apart from using the **Bench Marks** to control the heighting of surveys, such as control surveys for road, rail or pipe line construction, the **Bench Marks** around an area of proposed development can be used to adjust a set of imported **Google Earth DTM** grid heights, used for example, for the purpose of a preliminary contour display/model of a proposed development site. In general, there is a height shift between **Google Earth DTM** interpolated

heights and the actual ground heights represented by the **Bench Marks**. A comparison between the two sets of heights can be used to determine the local height shift to be applied to the **Google Earth DTM** values.

When comparing **Google Earth DTM** heights with the **Bench Mark** heights, it is important to bear in mind the following limitations :-

1. Due to the approximate positioning of the **Bench Marks**, avoid points that lie on steep ground.
2. Some **Bench Marks** are studs placed on the plinths of Trig beacons. In these cases, the heights of the Trig pillars (normally 1,4m) need be taken into account.

Using the "Locate and Add Nearest Bench Marks" programme

NB : *This programme forms a part of the **Conversions Module** and this Module must be an active part of the **SURPAC** License in order to be able to access the programme.*

The programme is loaded from the **Conversions Menu**, when selecting the **Locate and Add Nearest Bench Mark** Menu Item.

If the current Co-ordinate file is empty, the programme will display a warning message and abort as the Co-ordinate file must contain at least one Point in order for this programme to work.

The Co-ordinate file should have appropriate constants set. If no constants are used, then both the Y an X ordinates must have their full values.

As a starting default, the programme will assume the [Y, X] search position as being the centre of gravity of all existing Points in the current Co-ordinate file. The programme will use the further defaults of a Search Radius of 50Km and the number of Points to display as 10.

The results of this default search will be displayed. You may now change any of the search parameters required, as mentioned on the previous page

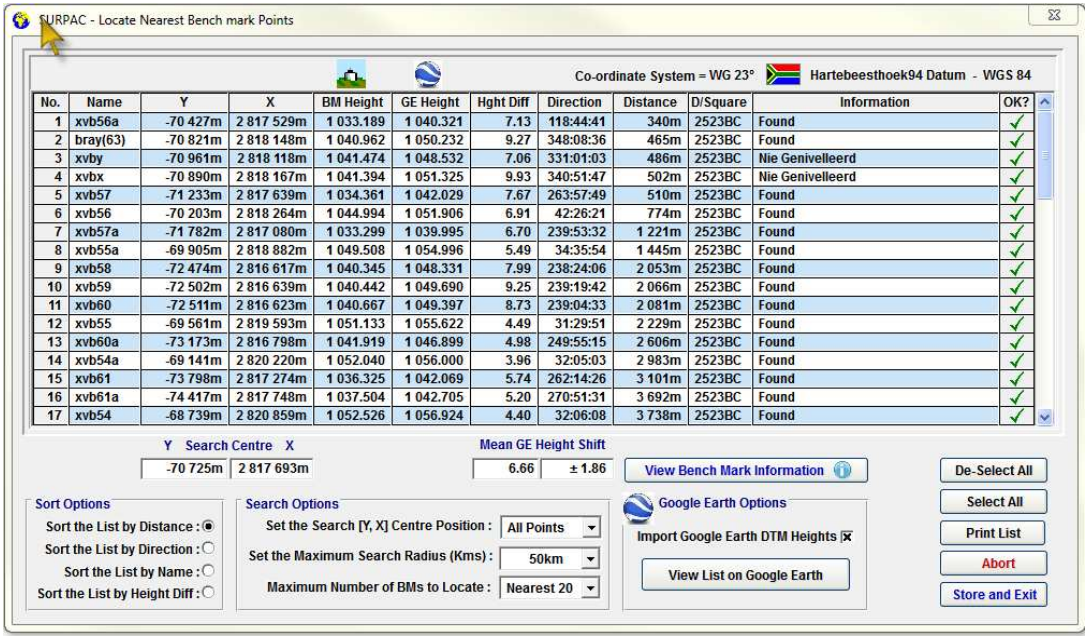
Each displayed **Bench Mark** will initially have a green "tick" displayed next to it. This implies that the **Bench Mark** is a "required" **Bench Mark** and which would be added to the current Co-ordinate file when the **[Store and Exit]** Button is clicked.

If any **Bench Mark** is not required, then click on that **Bench Mark's** green "tick". The symbol will be changed to a red "cross", and the **Bench Mark's** co-ordinate display will be changed to an italic font. This **Bench Mark** will now be flagged as "not required", and will not be added to the current Co-ordinate file. Clicking a Point's red "cross" will reverse the above process.

Click the **[Print List]** Button to send all those located and selected **Bench Marks** to the **SURPAC** Printing form. From this form display, this list may then be sent to the current **Printer**, to a User defined **ASCII** file, to an **Excel** file, or to the Windows **Clipboard**.

When the **[Store and Exit]** Button is clicked, all located **Bench Marks** displayed in the list, and having the green "tick" symbol next to them, will be **added** to the current **Co-ordinate File**.

In the form area designated "**Google Earth options**", it is possible to either import interpolated heights for the **Bench Mark** positions by interrogating the **Google Earth DTM**, or to send the list of selected **Bench Marks** to **Google Earth** for a spatial view of the set of **Bench Marks**. By clicking on a **Bench Marks** symbol on the **Google Earth** display, the **Bench Mark's** co-ordinate and height information is displayed, along with the Height Difference (if applicable) and any information related to the **Bench Mark**.
If the **Google Earth DTM** heights are displayed, the programme form will display the **Mean Google Earth Height Shift** and its Standard Deviation, for all selected (ticked) **Bench Marks**.



No.	Name	Y	X	BM Height	GE Height	Hght Diff	Direction	Distance	D/Square	Information	OK?
1	xvb56a	-70 427m	2 817 529m	1 033.189	1 040.321	7.13	118:44:41	340m	2523BC	Found	✓
2	bray(63)	-70 821m	2 818 148m	1 040.962	1 050.232	9.27	348:08:36	465m	2523BC	Found	✓
3	xvby	-70 961m	2 818 118m	1 041.474	1 048.532	7.06	331:01:03	486m	2523BC	Nie Genivelleerd	✓
4	xvbx	-70 890m	2 818 167m	1 041.394	1 051.325	9.93	340:51:47	502m	2523BC	Nie Genivelleerd	✓
5	xvb57	-71 233m	2 817 639m	1 034.361	1 042.029	7.67	263:57:49	510m	2523BC	Found	✓
6	xvb56	-70 203m	2 818 264m	1 044.994	1 051.906	6.91	42:26:21	774m	2523BC	Found	✓
7	xvb57a	-71 782m	2 817 080m	1 033.299	1 039.995	6.70	239:53:32	1 221m	2523BC	Found	✓
8	xvb55a	-69 905m	2 818 882m	1 049.508	1 054.996	5.49	34:35:54	1 445m	2523BC	Found	✓
9	xvb58	-72 474m	2 816 617m	1 040.345	1 048.331	7.99	238:24:06	2 053m	2523BC	Found	✓
10	xvb59	-72 502m	2 816 639m	1 040.442	1 049.690	9.25	239:19:42	2 066m	2523BC	Found	✓
11	xvb60	-72 511m	2 816 623m	1 040.667	1 049.397	8.73	239:04:33	2 081m	2523BC	Found	✓
12	xvb55	-69 561m	2 819 593m	1 051.133	1 055.622	4.49	31:29:51	2 229m	2523BC	Found	✓
13	xvb60a	-73 173m	2 816 798m	1 041.919	1 046.899	4.98	249:55:15	2 606m	2523BC	Found	✓
14	xvb54a	-69 141m	2 820 220m	1 052.040	1 056.000	3.96	32:05:03	2 983m	2523BC	Found	✓
15	xvb61	-73 798m	2 817 274m	1 036.325	1 042.069	5.74	262:14:26	3 101m	2523BC	Found	✓
16	xvb61a	-74 417m	2 817 748m	1 037.504	1 042.705	5.20	270:51:31	3 692m	2523BC	Found	✓
17	xvb54	-68 739m	2 820 859m	1 052.526	1 056.924	4.40	32:06:08	3 738m	2523BC	Found	✓

The "Locate and Add Nearest Bench Marks" programme display

Display of Bench Marks on Google Earth, showing information for a selected Bench Mark

The **Google Earth** icon used by **SURPAC** Software for **Bench Marks** is :-

- Bench Marks

Creating Arcs and Circles on a Google Earth display

Drawing Arcs, Circles and Dashed/Dotted Lines on Google Earth

The **KML** language used to generate **KML** files on **Google Earth** only provides for limited line drawing options. Available options are line width and line colour and apply to straight lines only.

However, **SURPAC** provides routines for line styling (dotted lines, dashed lines etc.) by means of adding extended functions to handle such lines.

Functions also exist in the **SURPAC General CAD** programme to enable the plotting of **Arcs** and **Circles** on **Google Earth** via a **KML** file. **Arcs** may be solid, dotted or dashed.

Example of a SURPAC KML file displayed on Google Earth, including Arcs and Circles

Locating and Adding My Nearest Stations Programme

The "My Stations" files

SURPAC allows you to create and store two "**My Stations**" files, one for the **Clarke 1880** (**Modified**) ellipsoid (e.g. the RSA "Lo" datum, Arc 1950, Arc1960, UTM etc.), and the **WGS 1984** ellipsoid (e.g. RSA Hartebeeshoek94 datum, UK National GPS Network, New Zealand Geodetic Datum (NZGD2000), UTM etc.).

These files are called "**My Stations (Lo)**" and "**My Stations (WG)**" respectively, and are stored in the same folder as the **SURPAC** application, usually the "C:\Surpac Software" folder.

The purpose of these files is to allow Surveyors to store their own **Stations** (or any other required points) in the above files and to have the ability to locate and import the nearest of these **Stations** into any Co-ordinate file.

Each **Station** stored in either of the two "**My Stations**" files consists of the following data :-

- ***Name***
- ***Latitude***
- ***Longitude***
- ***Y Co-ordinate (or Easting)***
- ***X Co-ordinate (or Northing)***
- ***System (e.g. WG 27°, Lo 19°, Zone 35 etc.)***
- ***Height***
- ***Aux. Height***
- ***Field #1 (as set in the Source file)***
- ***Field #2 (as set in the Source file***
- ***Description***
- ***Source File Path/Name***

When displaying the nearest **Stations**, the following are also shown :-

- ***Direction***
- ***Distance***

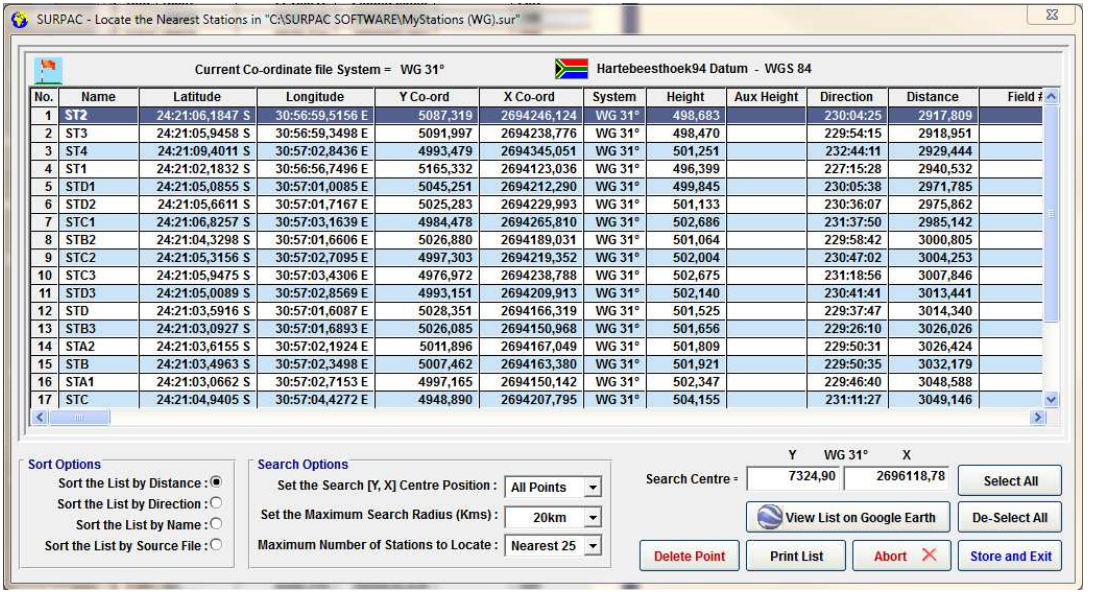
Which are determined from the currently chosen **Search Centre** position.

Since the two "**My Stations**" files are stored in [**Lat**, **Long**] format, any Degree Square boundaries become irrelevant to the programme. Surveys can be located close to any Degree Square boundary, and the programme will still

generate its own, temporary "Degree Square" of Points, centered about the Survey, or any defined Point in the Survey. Data may be drawn from different Degree Squares for any given Survey.

The programme offers User options for both the selection of **Stations**, and the display mode used, namely :-

- The **Search Centre position** may be User selected,
- The **number of located Stations** displayed may be set according to a required **maximum number**, or a required **maximum search radius**,
- The **display of located Stations** may be in order of **Distance**, **Direction**, **Point Name** or **Source File**.
- Any of the **located Stations** in the displayed list may be tagged as "**not required**", to prevent them from being added to the Co-ordinate file, or displayed on **Google Earth**.
- An **Output** of the displayed list of located and selected **Stations** may be made to the **Printer**, an **ASCII** file, an **Excel** file or the **Clipboard**.
- The **located Stations** in the displayed list, marked as "**required**" (i.e. the selected **Stations**) may be **added** to the current **Co-ordinate File**.
- The list of **Stations** may also be displayed on **Google Earth**.


SURPAC - Locate the Nearest Stations in "C:\SURPAC SOFTWARE\MyStations (WG).sur"
Current Co-ordinate file System = WG 31°
Hartebeesthoek94 Datum - WGS 84
Sort Options
Sort the List by Distance :
Sort the List by Direction :
Sort the List by Name :
Sort the List by Source File :
Search Options
Set the Search [Y, X] Centre Position : All Points
Set the Maximum Search Radius (Kms) : 20km
Maximum Number of Stations to Locate : Nearest 25
Search Centre = Y 7324,90 WG 31° X 2696118,78
Select All
View List on Google Earth
De-Select All
Delete Point
Print List
Abort
Store and Exit

No.	Name	Latitude	Longitude	Y Co-ord	X Co-ord	System	Height	Aux Height	Direction	Distance	Field #
1	ST2	24:21:06,1847 S	30:56:59,5156 E	5087,319	2694246,124	WG 31°	498,683		230:04:25	2917,809	
2	ST3	24:21:05,9458 S	30:56:59,3498 E	5091,997	2694238,776	WG 31°	498,470		229:54:15	2918,951	
3	ST4	24:21:09,4011 S	30:57:02,8436 E	4993,479	2694345,051	WG 31°	501,251		232:44:11	2929,444	
4	ST1	24:21:02,1832 S	30:56:56,7496 E	5165,332	2694123,036	WG 31°	496,399		227:15:28	2940,532	
5	STD1	24:21:05,0855 S	30:57:01,0085 E	5045,251	2694212,290	WG 31°	499,845		230:05:38	2971,785	
6	STD2	24:21:05,6611 S	30:57:01,7167 E	5025,283	2694229,993	WG 31°	501,133		230:36:07	2975,862	
7	STC1	24:21:06,8257 S	30:57:03,1639 E	4984,478	2694265,810	WG 31°	502,686		231:37:50	2985,142	
8	STB2	24:21:04,3298 S	30:57:01,6606 E	5026,880	2694189,031	WG 31°	501,064		229:58:42	3000,805	
9	STC2	24:21:05,3156 S	30:57:02,7095 E	4997,303	2694219,352	WG 31°	502,004		230:47:02	3004,253	
10	STC3	24:21:05,9475 S	30:57:03,4306 E	4976,972	2694238,788	WG 31°	502,675		231:18:56	3007,846	
11	STD3	24:21:05,0089 S	30:57:02,8569 E	4993,151	2694209,913	WG 31°	502,140		230:41:41	3013,441	
12	STD	24:21:03,5916 S	30:57:01,6087 E	5028,351	2694166,319	WG 31°	501,525		229:37:47	3014,340	
13	STB3	24:21:03,0927 S	30:57:01,6893 E	5026,085	2694150,968	WG 31°	501,656		229:26:10	3026,026	
14	STA2	24:21:03,6155 S	30:57:02,1924 E	5011,896	2694167,049	WG 31°	501,809		229:50:31	3026,424	
15	STB	24:21:03,4963 S	30:57:02,3498 E	5007,462	2694163,380	WG 31°	501,921		229:50:35	3032,179	
16	STA1	24:21:03,0662 S	30:57:02,7153 E	4997,165	2694150,142	WG 31°	502,347		229:46:40	3048,588	
17	STC	24:21:04,9405 S	30:57:04,4272 E	4948,890	2694207,795	WG 31°	504,155		231:11:27	3049,146	

The "Locate and Add My Nearest Stations" programme display

Adding Stations to the "My Stations (Lo)" or "My Stations (WG)" files

Load the **Co-ordinate File** that contains the required **Stations** that are to be added to the "**My Stations**" file, making it the current **Co-ordinate File**. **SURPAC** will note the System of the current **Co-ordinate File** and will open the appropriate "**My Stations**" file (i.e. "**Lo**" or "**WG**").

Mark (highlight) a Station, or Stations, that are to be added to the " **My Stations**" file :-

To Highlight a block of Stations : Use the "**Click and drag**" method or the [**Shift] + Click** method.

To Highlight Separate Stations : Use the [**Ctrl**] **+ Click** method.

Once all required **Stations** have been highlighted, the cursor should be over either the last **Station** selected, or over the green tick box near the top right of the display. In either case Click the mouse Right hand button to display the Co-ordinate display's pop-up menu.

On this menu, select the **Add Station(s) to "My Stations (WG)" file** or **Add Station(s) to "My Stations (Lo)" file**, as the case may be.

If a **Station** of the same **Name** and originating from the same **Co-ordinate File** already exists in the "**My Stations**" file, the programme will prompt you to either accept the existing **Station** values, or to overwrite the values.

NB : ***Stations*** *having duplicate* ***Names*** *can be stored in the "****My Stations****" files, as long as they originate from different* ***Source*** *files.*

The term "Station" is used throughout this discussion, however any Point, such as a Reference Mark, Outside Figure Point etc. may be stored in either of the "My Station" files.

Using the "Locate and Add My Nearest Stations" programme

NB : *This programme forms a part of the* ***Conversions Module*** *and this Module must be an active part of the* ***SURPAC*** *License in order to be able to access the programme.*

The programme is loaded from the **Conversions Menu**, when selecting the **Locate and Add My Nearest Stations** Menu Item.

If the current **Co-ordinate File** is empty, the programme will display a warning message and abort as the **Co-ordinate File** must contain at least one Point in order for this programme to work.

The **Co-ordinate File** should have appropriate constants set. If no constants are used, then both the Y an X ordinates must have their full values.

As a starting default, the programme will assume the [Y, X] search position as being the centre of gravity of all existing Points in the current **Co-ordinate File**. The programme will use the further defaults of a Search Radius of 20Km and the Number of Points to display as 25.

The results of this default search will be displayed. You may now change any of the search parameters required, as mentioned on the previous page.

NB : *The information line displayed for each **Station** is too long to be displayed in total on a standard display page. To view the full **Station** information, use the horizontal scroll bar at the bottom of the data display*.

Each displayed **Station** will initially have a green "tick" displayed next to it (at the right hand side of the display). This implies that the **Station** is a "required" **Station** which would be added to the current **Co-ordinate File** when the **[Store and Exit]** Button is clicked, or displayed on **Google Earth** when the [**View List on Google Earth**] Button is clicked.

If any **Station** is not required, then either click on that **Station**'s green "tick", or Double Click on any one of the displayed **Station** data items. The symbol will be changed to a red "cross", and the **Bench Mark's** co-ordinate display will be changed to a grey italic font. This **Station** will now be flagged as "not required", and will not be added to the current **Co-ordinate File**, or displayed on **Google Earth**. Clicking a Point's red "cross", or Double Clicking on any one of the displayed **Station** data items will reverse the above process.

NB : *The [**Select All**] and [**De-Select All**] Buttons can be used to designate all **Stations** as Selected (**Required**), or De-Selected (**Not Required**), respectively.*

A **Station** may be **Deleted** from the "**My Stations**" file by highlighting the required **Station** line (by Clicking on it) and then Clicking the [**Delete Point**] Button. Once a **Station** has been **Deleted**, it can only be replaced by **Adding** it from the appropriate **Co-ordinate File**, as described above.

Click the **[Print List]** Button to send all those located and selected **Stations** to the **SURPAC** printing form. From this form, this list may then be sent to the

current **Printer**, to a User defined **ASCII** file, to an **Excel** file, or to the Windows **Clipboard**.

NB : *Due to the width of the information data lines for the **Stations**, it is best to send the display to an **Excel**, where the full display information data is included*

When the **[Store and Exit]** Button is clicked, all located **Stations** displayed in the list, and having the green "tick" symbol next to them, will be **added** to the current **Co-ordinate File**.

As long as **Google Earth** is installed on the computer, the selected list of **Stations** may be sent to **Google Earth** (via a **KML** file) to provide a spatial view of the set of **Stations**. This is only applicable if the current **Co-ordinate File** uses a System based on the **WGS 1984** ellipsoid

By clicking on the [**View List on Google Earth**] Button (if active) all the selected (required) **Stations** will be displayed on **Google Earth**. Clicking on any of these displayed **Stations** in **Google Earth** will display the **Station**'s system, co-ordinate and height information, Latitude, Longitude and point description.

The SURPAC Google Earth Icon set

The full set of **Google Earth** icons used by **SURPAC** Software is :-

- Trigonometrical Beacons

- Town Survey Marks

- Bench Marks

- Survey Beacons/Points

- Image Placemarks or Polygons

- My Stations

*Please note that the "**hot Spot**" that identifies the position of the item is the **bottom centre** of the icon*.

Display of Stations on Google Earth, showing information for a selected Station